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THE
DISEASES OF INFANCY AND CHILDHOOD

FOR THE USE OF STUDENTS
AND PRACTITIONERS OF MEDICINE

BY

L. EMMETT HOLT, A. M., M. D., 1855-1924

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TO THE NURSERY AND CHILD'S AND THE BABIES' HOSPITALS, NEW YORK;
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TO THE HOSPITAL FOR THE RUPTURED AND CRIPPLED

WITH TWO HUNDRED AND FOUR ILLUSTRATIONS
INCLUDING SEVEN COLOURED PLATES

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1898

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TO

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THIS VOLUME IS INSCRIBED

AS A TRIBUTE TO HIS PERSONAL WORTH AND HIGH PROFESSIONAL ATTAINMENTS,

AND IN GRATEFUL REMEMBRANCE OF MANY ACTS OF KINDNESS,

BY THE AUTHOR.

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PREFACE.

THE rapid advance made during the past few years in this department of medicine is a sufficient justification, if one were needed, for another general work on the Diseases of Infancy and Childhood. It is not claimed that the present work is a complete one, for completeness in so broad a subject in a single volume is impossible. However, by omitting much material which does not strictly pertain to children, I have endeavoured to give a somewhat full discussion of matters which are peculiar to early life, the space allotted to each subject being in some degree commensurate with its practical importance to the physician and student. I have intentionally avoided entering into a discussion of many questions which belong to general medicine and which are fully treated in works upon that subject.

The pathology and symptomatology of disease in children who have passed their seventh or eighth year, really differ little from those of adolescents and young adults. It is in infancy and early childhood only that the peculiar conditions exist which separate pædiatrics from general medicine and entitle it to be ranked as a special department. These pages therefore are chiefly devoted to a consideration of the subjects of the nutrition and the diseases of infants and young children.

The discussion of questions relating to operative surgery has been purposely omitted. What is said regarding surgical diseases has been from the standpoint of the physician, not that of the surgeon, and relates chiefly to symptoms and early diagnosis.

Rather more space than is usual in a clinical work has been given to pathology and the description of lesions, my reasons for this being, first, that most of the processes which are peculiar to very early life have received but scant attention in works on pathology; secondly, such knowledge is absolutely indispensable to the correct understanding of these diseases clinically; and, thirdly, because I have been fortunate in having rather exceptional opportunities for post-mortem study in connection with my clinical work. It is hoped that the drawings and photographs of pathological conditions which have been inserted will render this part of the work of interest to the general practitioner, and be of some assistance and value to those whose opportunities for the study of disease in

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children are limited to the bedside. These illustrations have been selected with reference to their bearing on the symptomatology of disease and for the benefit of the practitioner, not the pathologist. In this as in all parts of the book I have tried to keep constantly in mind the every-day needs of the physician who practises among children and of the student who expects to do so.

The material has been gathered from eleven years' continuous hospital service among young children, and much of the statistical matter which has been introduced, relates to cases which have been under my own observation.

While as a whole the book is very largely a record of personal experience, I must express my great indebtedness to the rapidly increasing number of active workers in pædiatrics both in America and in Europe.

The arrangement of the book differs somewhat from that of other works on the subject. The space given to nutrition, to its derangements, and to the diseases resulting therefrom, is, I think, not out of proportion to their importance. There can be little question regarding the propriety of placing rickets and scurvy in this class. It is hoped that the plan of grouping in a single chapter the various therapeutic measures useful in early life may aid the reader who wishes to consult the book on these points. In the parts relating to treatment, great, but I think not undue, stress has been laid upon diet and hygienic measures, since in them rather than in drug-giving lies the secret of success, certainly in all disorders of digestion and nutrition.

The illustrations are for the greater part original, being either from photographs or drawings of my own cases. Most of the drawings are by Dr. Henry Macdonald. For all borrowed illustrations credit has been given. For some of the latter I wish to thank Messrs. William Wood & Co. and the J. B. Lippincott Company, who have allowed the use of cuts from their publications.

I wish to express my obligations to Prof. James W. McLane, who kindly placed at my disposal the valuable records of the Sloane Maternity Hospital, from which the statistics relating to the newly-born child have been largely drawn.

I am also deeply indebted to Drs. Charles G. Kerley and Martha Wollstein for the tabulation of cases from hospital records and for other valuable assistance; to Dr. Thomas S. Southworth for suggestions in the chapter on Diseases of the Blood and for the preparation of the index; to my brother, Dr. N. Curtice Holt, for the revision of the proof sheets of the entire book; and, finally, to my publishers for their uniform courtesy and hearty co-operation at every stage of the work.

L. EMMETT HOLT.

15 EAST FIFTY-FOURTH STREET,
NEW YORK, *November 25, 1896.*

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THE DISEASES OF INFANCY AND CHILDHOOD.

PART I.

CHAPTER I.

HYGIENE AND GENERAL CARE OF INFANTS AND YOUNG CHILDREN.

THE physical development of the child is essentially the product of the three factors—inheritance, surroundings, and food. The first of these it is beyond the physician's power to alter; the second is largely and the third almost entirely within his control, at least in the more intelligent classes of society. These two subjects, infant hygiene and infant feeding, are the most important departments of pediatrics.

The Care of the Newly-Born Child.—After the ligature of the cord the child should be wrapped in a thick blanket and placed in a warm room. In hospital practice the eyes should be cleansed with absorbent cotton and water which has been boiled, and then two or three drops of a two-per-cent solution of nitrate of silver, after Credé's method, instilled into each eye by means of a glass rod or eye-dropper. In private practice a saturated solution of boric acid may be substituted, unless the mother has had a purulent vaginal discharge, in which case the silver solution should always be used. The bath should now be given in a warm room; the body being first oiled thoroughly in order to remove the vernix caseosa and then washed in water at a temperature of 100° F. The mouth should be cleansed with plain tepid water and a soft cloth, and no violence employed. The cord may be covered with salicylic acid one part and starch nineteen parts, or simply with subnitrate of bismuth, and wrapped in absorbent cotton or surgeon's lint. The abdomen should now be enveloped in a flannel band, eight or ten inches wide, and pinned rather snugly. Before dressing is completed, the child should be submitted to a thorough examination for injuries received during delivery, congenital deformities, also as to the condition of the respiration, circulation, etc.

After dressing, the child should be placed in its crib and covered with blankets, and if the feet are cold, or the fingers and lips a little blue, it should be surrounded by hot-water bottles covered with flannels, and placed near, but not in contact with, the body. The crib should be placed in a quiet, darkened room. The young infant should not occupy the same bed as the mother, unless it greatly needs the warmth of her body, other means of artificial heat not being at hand.

The cord should be kept dry and disturbed as little as possible until it falls off. Under ordinary circumstances the cord separates from the fourth to the seventh day, the average being the fifth day. The stump should then be covered with the salicylic acid and starch powder, and a pad of muslin about one fourth of an inch thick and two inches square applied and secured in position by means of the abdominal band. The purpose of this is to prevent umbilical hernia. The pad should be continued for the first month. The use of stronger antiseptic dressings than that recommended is somewhat objectionable, since it preserves the cord too long and delays separation. The full bath should not be given until the cord has separated.

The physician should always see to it that the infant cries enough to keep the lungs properly expanded.

The question of food for the newly-born infant is considered in the chapter upon infant feeding.

Bathing.—For the first few months the bath should be given at 98° F. The room should be warm, preferably there should be an open fire. The bath should be short and the body dried quickly, without too vigorous rubbing. The addition of salt to the bath is an advantage where the skin is unusually delicate or excoriations are present. One large handful should be used to a gallon of water. By the sixth month the temperature of the bath for healthy infants may be lowered to 95° F., and by the end of the first year to 90° F. Older children who are healthy should be sponged or douched for a moment at the close of the tepid bath with water at 65° or 70° F. During childhood the warm bath is preferably given at night. In the morning a cold sponge bath is desirable. This should be given in a warm room and while the child stands in a tub partly filled with warm water. This cold sponge should last but half a minute, and be followed by a brisk rubbing of the entire body.

In some young infants and even older children there is no proper reaction after the bath, even when given at the temperatures mentioned; children being pale, slightly blue about the lips and under the eyes. All tub bathing, and especially all cold bathing, should then be stopped, since a continuance can only be a drain upon the child's vitality.

Clothing.—The clothing of infants should be light, warm, non-irritating to the skin, and loose enough to allow free motion of the extremities; nor should bands be pinned so tightly about the trunk as to embarrass the movements either of the chest or of the abdomen. The chest should be covered with a woollen shirt, high in the neck and with long sleeves. All petticoats should be supported from the shoulders and not from waistbands. Canton flannel and stockinet are both superior as absorbents to the more commonly used linen diapers. Stockinet has the advantage of being very soft and pliable. Care should be given that in infants the feet be kept warm. If the circulation is very poor, a bag of hot water should always be in the crib. Cold feet are responsible for many attacks of colic and indigestion.

The abdominal band is usually worn during infancy. It cannot be considered in any sense a necessity after the first few months, excepting in cases of very thin infants whose supply of fat in the abdominal walls is an insufficient protection to the viscera. For the first few weeks a band of plain flannel is to be preferred; later, a knitted band with shoulder-straps. The fashion of low neck and short sleeves for infants and very young children has fortunately passed away—let us hope, never to return.

During the summer the outer clothing should be light and the under clothing of the thinnest flannel or gauze. The changes in the temperature of morning and evening may be met by extra wraps. The custom of allowing young children to go with legs bare has many enthusiastic advocates; while it may not be objectionable during the heat of summer, its advantages at any season are very questionable in a changeable climate like that of New York or the Atlantic coast. Many delicate children are certainly injured by such ill-advised attempts at hardening.

The night clothing of infants should be similar to that worn during the day, but should be loose, the material being of the lightest flannel. The night clothing for older children should consist of a thin woollen shirt and a union suit with waist and trousers, and in some cases with feet, if there is a tendency to get outside the coverings. The common mistake is to overload all children, but especially infants, with covering at night. This is an explanation of much of the restless sleep which is seen particularly in delicate children.

Care of the Eyes.—During the first few days at the daily bath, the eyes should be cleansed with a saturated solution of boric acid. They should be carefully protected from too strong light during early infancy. It is desirable that a child should always sleep in a darkened room.

Care of the Mouth and Teeth.—The mouth of the newly-born infant should be gently cleansed at each morning bath with boiled water and a soft cloth. On the first appearance of thrush the mouth should be washed after every feeding with a solution of bicarbonate of soda or borax (twenty grains to the ounce). Harm is often done by the use of too much force in cleansing the mouth of a young infant.

The primary teeth as well as those of the permanent set should receive daily attention. Too often they are neglected altogether. Dirty teeth are likely sooner or later to become carious; and carious teeth, besides being a cause of bad breath and neuralgia, are a constant menace to the health of the child, since they may harbour infectious germs of all varieties. Such teeth should either be filled or removed.

Care of the Skin.—The skin of a young infant is exceedingly delicate, and excoriations, intertrigo, and eczema are of very common occurrence. These conditions are much easier of prevention than of cure. The first essential in the care of the skin is cleanliness, and this must be secured without the use of strong soaps or too much rubbing. Napkins must be removed as soon as soiled or wet. Some bland absorbent powder, like starch, talcum, or the stearate of zinc, should be used in all the folds of the skin, in the neck, in the axillæ, groins, and about the genitals, and in the folds of the thighs, particularly in very fat infants. If plain water produces an undue amount of irritation, the salt or bran bath should be employed.

Care of the Genital Organs.—The female genitals need but little attention in young children, excepting as to cleanliness. This is more often neglected in older children than in infants. Vulvo-vaginitis is very common among the children of the poorer classes where cleanliness is neglected.

In males the prepuce should receive attention during the first few weeks of life. If the foreskin is long and the preputial orifice small, circumcision should invariably be done. If it is not long, but is only adherent, these adhesions should be broken up, the parts thoroughly cleansed and the foreskin retracted daily until there is no disposition to a recurrence of the adhesions. These operations will be discussed more at length in a subsequent chapter. The only thing to be emphasised in the present connection is that the prepuce should receive proper attention in early infancy, since this can now be done with less pain and discomfort to the child, and at the same time better results are obtained. If this matter is neglected during infancy, it is apt to be overlooked until harm has been produced by local or reflex irritation which phimosis or adherent prepuce may have excited.

Vaccination.—This, although considered elsewhere, should be mentioned in this connection as among the things requiring the physician's attention during the first months of life.

Training to Proper Control of Rectum and Bladder.—It is surprising to see what can be accomplished by intelligent efforts at training in these particulars. An infant can often be trained at three months to have its movements from the bowels when placed upon a small chamber. This not only saves a great amount of washing of napkins, but there is soon formed a habit of having the bowels move at a regular time or times each day. The infant must be put upon the chamber soon after its feeding. The importance of training young children to regular habits regarding evacuations from the bowels can hardly be overestimated. It should be impressed upon every mother and nurse by the physician, and especially the necessity of beginning training during infancy. Much of course will depend upon the food and the digestion; but habit is a very large factor in the case.

The training of the bladder is not quite so important, but the proper education of this organ adds much to the comfort of the child and the ease with which it is cared for. Before the end of the first year most intelligent children can be trained to indicate a desire to empty the bladder. Many mothers and nurses succeed in training children so well that by the tenth or eleventh month napkins are dispensed with during the day. On the other hand, it is very common to see children of two and even two and a half years still wearing napkins because of the lack of proper training. Before it has reached the latter age a healthy child should go from 10 P. M. until morning without emptying the bladder. The annoyance and discomfort from the neglect of early training in this particular are very great. Night feeding is responsible for much of the difficulty experienced in training children to hold the water during the night.

General Hygiene of the Nervous System.—Great injury is done to the nervous system of children by the influences with which they are surrounded during infancy, especially during the first year. The brain grows more during the first two years than in all the rest of life. Normal healthy development of the nervous centres demands quiet, rest, peaceful surroundings, and freedom from everything which causes excitement or undue stimulation.

The steadily increasing frequency of functional nervous diseases among young children is one of the most powerful arguments for greater attention by physicians to the subject of the hygiene of the nervous system during infancy. Most parents err through ignorance. Playing with young children, stimulating to laughter and exciting them by sights, sounds, or movements until they shriek with apparent delight, may be a source of amusement to fond parents and admiring spectators, but it is almost invariably an injury to the child. This is especially harmful when done in the evening. It is the plain duty of the physician to enlighten parents upon this point, and insist that the infant shall be kept quiet, and that all such playing and romping as has been referred to shall, during the first year at least, be absolutely prohibited.

Sleep.—The sleep of the newly-born infant is profound for the first two or three days and under normal conditions almost continuous. In the case of prolonged or tedious labor, or where from any cause undue compression has been exerted upon the head, it may approach the condition of semi-coma for twenty-four or forty-eight hours. This may be so deep as to excite apprehensions of serious brain lesions. If, however, there are associated with it no convulsions and no rigidity, this early stupor usually passes away on the second or third day.

The sleep of early infancy is quiet and peaceful, but not very deep after the first month. After the third year the heavy sleep of childhood is commonly seen. A healthy infant during the first few weeks sleeps from twenty to twenty-two hours out of the twenty-four, waking only from hunger, discomfort, or pain. During the first six months a healthy infant will usually sleep from sixteen to eighteen hours a day, the waking periods being only from half an hour to two hours long. At the age of one year most infants sleep from fourteen to fifteen hours, viz., from eleven to twelve hours at night, and two or three hours during the day, usually in two naps. When two years old usually thirteen to fourteen hours' sleep are taken; eleven or twelve hours at night and one or two hours during the day, generally in a single nap. At the age of four years children require from eleven to twelve hours' sleep. It is always desirable, and in most cases with regularity it is possible, to keep up the daily nap until children are four years old. From six to ten years the amount of sleep required is ten or eleven hours, and from ten to sixteen years nine hours should be the minimum.

Training in proper habits of sleep should be begun at birth. From the outset an infant should be accustomed to being put into its crib while awake and to go to sleep of its own accord. Rocking and all other habits of this sort are useless and may even be harmful. An infant should not be allowed to sleep on the breast of the nurse, nor with the nipple of the bottle in its mouth. Other devices for putting infants to sleep, such as allowing the child to suck a rubber nipple or anything else, are positively injurious. If such means of inducing sleep are resorted to the infant soon acquires the habit of not sleeping without them. I have known of one instance where the habit of rocking during sleep was continued until the child was two years old; the moment the rocking was stopped the infant would wake, and in consequence this practice was continued by the devoted but misguided parents. A quiet, darkened room, a warm and comfortable bed, an appetite satisfied, and dry napkins are all that are needed to induce sleep in a healthy child.

The periods of sleep in young infants are usually from two to three hours long, with the exception of once or twice in the twenty-four hours, when a long sleep of five or six hours occurs. The purpose of training is to have the child take this long sleep at night. The habit of regular sleep is best established by wakening the infant regularly every two or two and a half hours during the day for feeding, and allowing it to sleep as long as possible during the night. This training goes hand-in-hand with regular habits of feeding. Such habits are easily formed if the plan be systematically followed from the outset.

By the fifth month all feeding between 10 P. M. and 7 A. M. should be discontinued. If this is done most infants can be trained by this time to sleep all night. If the room is lighted, and the child taken from the crib or rocked or fed as soon as it wakens at night, there is no such thing as the formation of good habits of sleep. Regularity in sleep and feeding not only make the care of young infants very much easier, but they are of a good deal of importance for the health of the child.

The causes of disturbed or irregular sleep in young infants are mainly two—hunger and indigestion. In nursing infants it is usually the former; in those artificially fed usually the latter. Sleeplessness from hunger is often seen in children who are nursed thirty or forty minutes and then fall asleep, but wake in fifteen or twenty minutes crying and fretful. After being quieted they may fall asleep again for half an hour, but wake at short intervals. The peaceful sleep of two or three hours which should follow a proper feeding is never seen. With this restlessness other signs of indigestion are usually present, such as bad stools, stationary weight, etc. The disturbed sleep due to overfeeding shows itself by much the same symptoms, excepting that the first sleep after the meal is usually longer.

Exercise.—This is no less important in infancy than in later childhood. An infant gets its exercise in the lusty cry which follows the cool sponge of the bath, in kicking its legs about, waving its arms, etc. By these means pulmonary expansion and muscular development are increased and the general nutrition promoted. An infant's clothing should be such as not to interfere with its exercise. Confinement of the legs should not be permitted. In hospital practice I have often had a chance to observe the bad results which follow when very young infants are allowed to lie in the cribs nearly all the time. Little by little the vital processes flag, the cry becomes feeble, the weight is first stationary, then there is a steady loss. The appetite fails so that food is at first taken without relish, then at times altogether refused; later, vomiting ensues and other symptoms of indigestion. This, in many cases, is the beginning of a steady downward course which goes on until a condition of hopeless marasmus is reached. Such infants must be taken up every few hours and carried about the wards; the position should be frequently changed, and general friction of the entire body employed at least twice a day. Every means must be made use of to stimulate the vital activity. The value of systematic attention to these matters cannot be overestimated in hospitals for infants. Infants who are old enough to creep or stand usually take sufficient exercise unless they are restrained. At this age they should be allowed to do what they are eager to do. Every facility should be afforded for using their muscles. Exercise may be encouraged by placing upon the floor in a warm room a mattress or a thick "comfortable," and allowing the infant to roll and tumble upon it at will. A large bed may answer the same purpose.

In older children every form of out-of-door exercise should be encouraged—ball, tennis, and all running games, horseback riding, the bicycle, tricycle, swimming, coasting, and skating. Up to the eleventh year no difference need be made in the exercise of the two sexes. Companionship is a necessity. Children brought up alone are at a great disadvantage in this respect, and are not likely to get as much exercise as they require. The amount of exercise allowed delicate children should be regulated with some degree of care. It may be carried to the point of moderate muscular fatigue, but never to muscular exhaustion. The latter is particularly likely to be the case in competitive games.

Exercise should have reference to the symmetrical development of the whole body. In prescribing it the specific needs of the individual child should be considered. By carefully regulated exercises very much may be done to check such deformities as round shoulders and slight lateral curvature of the spine, and also to develop narrow chests and feeble thoracic muscles. For purposes like these, gymnastics are exceedingly valuable to supplement out-of-door exercise, but they can never take their place.

There are two important points with reference to exercise indoors: First, the playroom should be cool—from 60° to 65° F.; never above this point. Secondly, during all active exercise the clothing should be loose and light, so as to allow the freest possible motion of the body.

Airing.—In summer there can be no possible objection to a young infant being allowed out of doors at the end of the first week. It should be kept in the open air as much as possible during the day. In the fall and spring this should not be permitted until the child is at least a month old, and then only when the out-of-door temperature is above 60° F. During its outing the head should be protected from the wind and the eyes from the sun. The duration of the outing at first should be only fifteen or twenty minutes, the time being gradually lengthened to two or three hours. The child should be gradually accustomed to changes of temperature in the room by opening wide the windows for a few minutes each day even before it is taken out of doors, the child being dressed meanwhile as for an outing. In the case of children born late in the fall or in the winter this means of giving fresh air may be advantageously begun at one month and followed throughout the first winter. It is only necessary in all such cases that the changes be made very gradually both as to the length of the airing and to the temperature. The great advantage of this plan over that more commonly followed of keeping young infants closely housed for the first six months in case they are born in the fall or early winter, I can positively affirm from quite a wide observation of both methods. It is a matter of very serious importance that every infant be furnished an abundance of pure fresh air in winter as well as in summer. When the plan above outlined is carefully and judiciously followed, the tendency to catarrhal affections instead of being increased is thereby greatly lessened.

When four or five months old, there is no reason why a healthy child should not go out of doors on pleasant days if the temperature is not below 20° F. While there is a prejudice on the part of many mothers and some physicians against a child's sleeping out of doors in cold weather, it is a practice which I have always urged upon mothers, and have never seen followed by any but the most beneficial results. The days of all others when infants and very young children should not be out of doors are when there are high winds, especially those from the northeast, an atmosphere of melting snow, and during severe storms. Delicate infants must of course be more carefully guarded during the cold season. With most of these the plan of house-airing is all that should be attempted.

Nursery.—This should be the sunniest and best-ventilated room in the house. It is the physician's duty to see that proper attention is paid to the hygiene of the room in which the child spends at least four fifths of its time during the first year, and two thirds of its time during the first two or three years of life. Sunlight is absolutely indispensable. Sunny rooms always contain less organic matter and less humidity, and hence a room upon the north side of the house should always be avoided, preferably one in the second story should be chosen. Nothing which can in any way contaminate the air of the room should be allowed. There should be no drying of clothes or of napkins, and no plumbing. No food should be allowed to stand about the room. The gas should not be allowed to burn at night; a small wax night-light furnishes all that is needed in the nursery. If possible the heat should be from an open fire; the next best thing is the Franklin radiator. Nothing in the room is worse than steam heat from a radiator unless it be a gas stove which under no circumstances should be allowed, excepting possibly for a few minutes each morning during the bath.

The temperature of the room during the day should be 70° F., but better 68° than 72° F. It is important that every nursery should have a thermometer, and that this and not the sensations of the nurse should be the guide. It is almost invariably true that the nursery is overheated. Often no other explanation can be found for chronic indigestion and failing weight excepting a nursery whose habitual temperature ranges from 75° to 80° F. At night for the first few months the temperature should not be allowed to fall below 65° F. After the first year the night temperature may fall to 60° or even 55° F.

Free ventilation without draughts is an absolute necessity. This is best accomplished by ventilators in the windows, of which there are many excellent devices sold in the shops. While the child is absent from the room the windows should be widely opened and free airing of the nursery accomplished. The room should always be thoroughly aired at night before the child is put to bed. The window may be kept open even in the first year, unless the temperature out of doors is below 40° F. After the first year the window may be open, unless the outside temperature is as low as

20° F. If the window is open the door of the nursery should be closed, that currents of air may be avoided. The ventilation by means of an open fire is the most efficient.

The furniture of the nursery should be as simple as possible, heavy hangings should be positively forbidden, and upholstered furniture used only to a small extent. Floors covered by large rugs are much more cleanly than carpets, and hence are to be preferred.

The child, whenever it is possible, should have a separate bed; and so should the newly-born infant, in order to prevent the danger of overlying by the mother, which among the lower classes is a frequent cause of death, and also to avoid the danger of too frequent night nursing, which is injurious alike to mother and child. Separate beds for older children will prevent the spread of many forms of infection from the diseased child to the healthy. The cradle for infants should be one which does not rock, in order that this unnecessary and vicious practice should not be carried on. The mattress should be of hair and quite firm. The pillow should be small; in the summer, hair pillows are an advantage but not a necessity. The position of the child during sleep should be changed from time to time from one side to the other and then to the back. Attention to all these details should not be beneath the physician's notice, since the violation of these plain rules of hygiene is at the bottom of many of the milder disorders and even of some of the more serious diseases seen in infancy.

The Nurse.—The nurse of a young child should be healthy, young or in middle life, free from tuberculous or syphilitic taint, and from catarrhal affections of the nose and throat. She should be neat in habit, of quiet disposition, and, most of all, she should be a person of intelligence.

The Amount of Air Space required by Infants.—The nursery should always be as large a room as possible. One of the reasons why young infants do so badly in institutions is because of overcrowding. In a well-ventilated ward there should be allowed to each infant at least 1,000 cubic feet for the best results. Children over two years old are not so sensitive to their surroundings, and may thrive in wards where only 700 or 800 cubic feet are allowed to each child.

THE CARE OF PREMATURE AND DELICATE INFANTS.

Infants born before term, and some exceedingly delicate ones which are born at full term, require very special and particular care. The vitality is so feeble in these children that if they are handled in the ordinary way they survive at most but a few weeks. The symptom which indicates that such special care is necessary is most of all the weight of the child. Either congenital feebleness or prematurity may be assumed in most of the children weighing less than four pounds. This is certainly true of those weighing less than three pounds; also if the length of the body is less than nineteen inches. In these children all the organs are likely to be imperfectly developed and they are not ready for their work. Especially is this true of the lungs and of the organs of digestion.

The clinical picture presented by these cases is quite characteristic. The body is limp; the skin very soft and delicate and almost transparent; the cry, a low feeble whine not unlike the mew of a kitten; the respiratory movements, extremely irregular, sometimes scarcely perceptible for several seconds; the movements of the extremities infrequent and never vigorous. The general appearance is one of torpor. The muscles of the mouth and cheek and tongue may lack the requisite force for sucking, so that this is practically impossible, and even deglutition is slow, difficult, and prolonged. Unless very carefully protected the temperature of the body quickly falls to a subnormal point, and it is difficult to maintain the normal body heat. These symptoms vary much in degree according as the infants are born at six and a half, seven months, or only shortly before term.

In the management of these cases there are two problems to be solved: the first to maintain the animal heat, the second to nourish the infant. Difficult as it always is to rear a premature infant, these difficulties are much increased in cases where proper means are not adopted immediately after birth. The loss which these children sustain during the first few days is in very many cases so great that subsequent measures, however well carried out, are futile. The heat-producing power is so feeble that the body temperature quickly falls below normal unless artificial heat is constantly used. The effect of cold upon these delicate infants is very serious, and not only growth but even life depends upon maintaining the body temperature steadily and uniformly. Their extreme susceptibility is something which it is difficult for one to appreciate who has not had experience in these cases.

One of the simplest means of maintaining the temperature is to oil the skin and then roll the entire body in cotton batting, no clothing excepting the diaper being used. The body should then be wrapped in two or three blankets and surrounded by bottles or rubber bags containing hot water. These means are usually sufficient in infants of three and a half pounds or over, but in those much under this weight this is not enough. Where cotton is used it should be changed only once in two or three days, excepting about the buttocks. If absorbent cotton be used in this region instead of cotton batting, the napkin may be dispensed with altogether. This cotton may be changed as often as it is soiled by the discharges. These children should not be bathed, but the skin should be kept in a healthy condition by rubbing with sweet oil once in two or three days.

Incubators.—In the case of infants born in the seventh month, and in some even later than this, the animal heat which can be maintained by the means described is inadequate to the child's needs. For such cases an incubator must be employed. The following statistics are published by Tarnier, showing the results obtained in his hospital in Paris during five years with the incubator and for the five years before its introduction:

AGE.	Percentage saved with incubator.	Percentage saved without incubator.
Infants born at 6 months	16·0	....
" " " 6½ "	36·6	21·5
" " " 7 "	49·8	39·0
" " " 7½ "	77·0	54·0
" " " 8 "	88·8	78·0
" " " 8½ "	96·0	88·0

The essential thing to be secured in an incubator is a uniform temperature, which in the most delicate infants should be maintained at 96° to 98° F. In those a little more robust, from 80° to 95°. The air must at the same time be moistened, and there must be sufficient ventilation to keep it pure.

A modification of Tarnier's incubator is shown in the accompanying illustrations. (Figs. 1 and 2). This consists of a wooden box thirty inches long, fifteen inches wide, and twenty inches high. It is composed of an outer and inner box, each one half inch in thickness, with an air chamber one fourth of an inch in thickness separating them, excepting

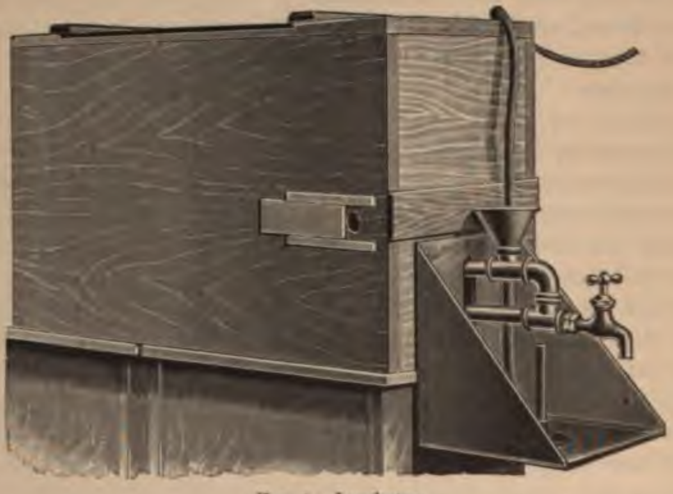

FIG. 1.—Incubator.

at the bottom, which is solid. It may be made solid throughout. The temperature is maintained by a large tank of warm water four inches in height which completely fills the bottom of the incubator. This is so arranged that it can be emptied and filled without opening the box. Connected with one end of the tank is a loop of brass pipe. To this is attached a funnel for filling and a faucet for emptying the tank. Beneath this pipe the heat is applied. The tank, which holds five or six gallons, is filled with hot water, and the heat is then maintained by the flame of a Bunsen burner or an alcohol lamp. The lamp stands upon a hanging shelf made of tin. Fresh air is admitted at four openings, three inches in diameter, two being on each side. A slide is so arranged that one or all of these can be opened as desired. The air passes over the upper surface of the tank, is moistened by a wet sponge, and finds its exit at the top. A thermometer is placed on the inside of the box just over the bed, so that the exact temperature can be seen. A portion of the cover consists of a sliding plate of glass, through which the child can be observed, and by partly opening which it can be fed. The infant lies upon a bed of cotton, in some cases naked, in others enveloped in the cotton. The discharges are received in the cotton upon which it lies. The infant is kept clean by the use of oil and cotton. It is not to be removed for feeding, since the food is usually given by gavage, and this can be done by sliding the cover. Every day the child should be taken out long enough to allow thorough cleansing and airing of the incubator, introduction of fresh cotton, etc.

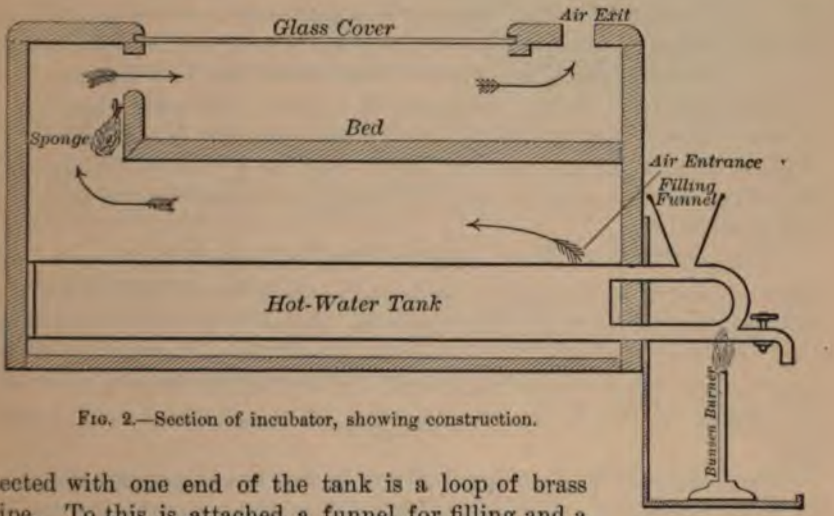

FIG. 2.—Section of incubator, showing construction.

This apparatus, which was devised by Dr. E. J. Sherow and myself, can be made by any carpenter and tinsmith at a very moderate expense. The only difficulty is with the ventilation. This is quite easy provided the temperature of the room in which the incubator stands is not over

65° or 68° F., but much more difficult when it is at 75° or over, as in warm weather. At such times all the doors for the entrance of air should be opened to the full extent and the glass cover opened from one half to two inches.

Rotch,* of Boston, has devised a very elaborate incubator which contains a very perfect heating and ventilating apparatus and also scales, so that the weight of the infant can be ascertained every day without removing it. This apparatus, which is without doubt the best that has been devised, is made of metal, principally of copper. The only objection is its cost. The apparatus which I have described above is one with which excellent results can be obtained, but it requires a little more care and attention. The essential thing in all cases is a constant temperature and free ventilation.

The child is kept in the incubator until it is nearly full term, or has become, judging by its activity, sufficiently strong to withstand the variations in temperature of an ordinary room. Before it is taken out permanently the temperature of the incubator should be gradually lowered by opening the cover more and more until it is only a little higher than the temperature of the room, clothing being of course added at the same time.

The feeding of the premature infant is not less important than the use of the incubator. Very few infants before eight months can be depended upon to take a proper amount of food from the breast or bottle. Forced feeding by means of gavage is indispensable in order to save these very young and very delicate children. This method of feeding is described elsewhere. The amount of food will depend upon the age of the child. At seven months one half ounce may be given every hour and a half, and at eight months three fourths of an ounce at the same interval. The food employed should if possible be breast milk. If artificially fed the feeding should be carried on as described in the chapter on the feeding of delicate children during the first year. With careful attention to details and intelligent co-operation on the part of a good nurse very many of these cases may be saved that otherwise would be absolutely hopeless.

The incubator thus far has not been so much employed in America as in Europe, where the most gratifying results have followed its use, particularly in Paris, St. Petersburg, and Moscow.

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* Archives of Pediatrics, August, 1893.

CHAPTER II.

GROWTH AND DEVELOPMENT OF THE BODY.

OBSERVATIONS upon growth and development are of the utmost importance during infancy and childhood. Only by this means are very many diseases detected in their incipiency. Early recognition carries with it in most cases the possibility of checking such pathological processes, as, if allowed to go on, may affect the health not only in infancy but even throughout life.

By familiarity with what is normal, detection of the abnormal soon becomes easy. Investigation in regard to these subjects should be made a part of the physical examination of every child.

WEIGHT.

The weight of the infant is the best means we have to measure its nutrition. It is as valuable a guide to the physician in infant feeding as is the temperature in a case of continued fever. Although the weight is not to be taken as the only guide to the child's condition, it is of such importance that we cannot afford to dispense with it during the first two years. It is a great advantage to keep up regular observations during childhood.

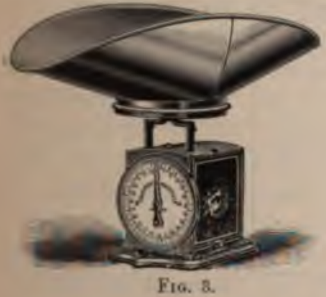
FIG. 3.

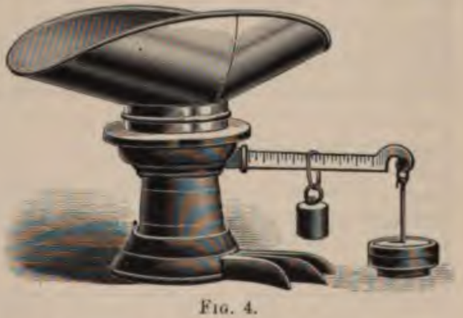
FIG. 4.

Weekly weighings should be made for the first six months, bi-weekly for the rest of the first year, and monthly during the second year. Delicate children should be weighed even more frequently. Satisfactory scales of moderate price for domestic use are those known in the shops as the "Universal Family Scales." (Fig. 3). These weigh up to twenty-four pounds and indicate ounces. For hospital use and for very fine observations more accurate scales are needed. In Fig. 4 are shown the scales I employ; they weigh up to sixty-one pounds and indicate half ounces.*

Weight at Birth.—The following figures are taken consecutively in nearly equal proportion from the records of the Nursery and Child's Hospital, the Sloane Maternity, and the New York Infant Asylum, and include only full-term children:

Average weight of 568 females	7·16 lbs.	(3,260 grammes).
" " 590 males	7·55 "	(3,400 ").
" " 1,158 infants	7·35 "	(3,330 ").

Weight Curve during the First Few Weeks.—The accompanying chart represents the variations in weight for the first twenty days. These observations were made upon one hundred healthy, nursing infants, fifty males and fifty females, at the Nursery and Child's Hospital. The children were weighed daily during the period of observation. The average weight at birth was 7·1 pounds. The curve shows a very marked loss of weight on the first day and a slight loss on the second day, the lowest point being touched at the beginning of the third day; but from this time there was a steady gain. The average initial loss in these cases was ten ounces, being in each sex exactly eleven per cent of the body weight. In eight hundred and thirty-five cases, however, including those above mentioned, the average loss was nine and a half ounces. The loss of the first days is chiefly due to the discharge of the meconium and urine, but is in part from the excess of tissue waste over the nutriment derived from the breasts. After the third day, coincident with an abundant secretion

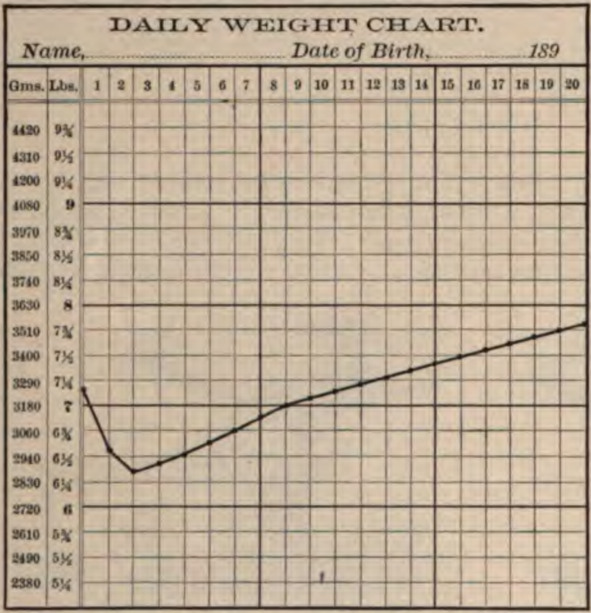

FIG. 5.—Weight curve of the first twenty days.

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* These are made by the Howe Scale Company.

of milk, there is a steady, daily increase in weight. If the milk is very scanty or is wanting altogether, the loss in weight continues.

The birth-weight of nursing children who thrive normally is regained on the average on the tenth day. The most frequent deviation from the normal curve consists in a continued loss or stationary weight after the third day. This may be due to acute illness, such as bronchitis, diarrhœa, pyæmia, or hæmorrhage, but in the majority of cases there is a disturbance of nutrition from improper or insufficient food. This is quite as likely to be the case in nursing infants as in those who are artificially fed. Under these circumstances the loss may continue indefinitely, and it may be slow or rapid according to the character of the nursing or feeding.

The weight curve in strong infants who are artificially fed in the proper way from the beginning, follows in some cases the same course as in nursing infants. There are many infants who, though properly fed, gain very little or not at all for two or three weeks, often not regaining the birth-weight until the end of the third or fourth week. Such infants should be closely watched and weighed twice a week, and if the weight is stationary, one should not be too ready to make a change in the food. A continued loss in weight, however, is an invariable indication that this should be done. It should be expected that most artificially fed infants will be slower in getting started, but in my experience their subsequent gain under favourable circumstances has been quite as regular and as rapid as that of average, breast-fed children.

There are cases in which an excessive loss of weight during the first three or four days is associated with an elevation of temperature, but without any other evident signs of disease. Both the fever and the rapid loss in weight are to be looked upon as due to the same cause—inanition. This will be more fully considered in the chapter devoted to that subject.

Excessive loss in weight during the first few days from any cause whatsoever, seriously handicaps an infant during the first weeks of its life. The great importance of this has not been sufficiently appreciated. Loss in weight after the second day is an indication for food in addition to that derived from the breast.

Weight Curve of the First Year.—The curve of the accompanying chart is made up from complete weight charts of one hundred healthy nursing infants who were thriving and weighed every week, and the incomplete charts of about three hundred others. There are represented in round numbers about ten thousand observations on children under one year. The period of most rapid increase is during the first three months. It is slowest from the sixth to the ninth month. This curve is not to be regarded as a normal line, like the normal line of the temperature chart, but as an average line. An infant who is at birth a pound above the average may keep this distance above the line for the whole year; another weighing one pound less than the average may be as far below it. Girls throughout the year are on the average half a pound lighter than boys. No single child exactly follows the line all the way, but it is surprising to see how close to it a very large number of the cases come.

In artificially-fed infants—provided the feeding is properly done—the curve does not differ essentially from that of breast-fed infants, excepting in the slower gain of the first one or two months, although this difference is usually made up before the sixth month is reached.

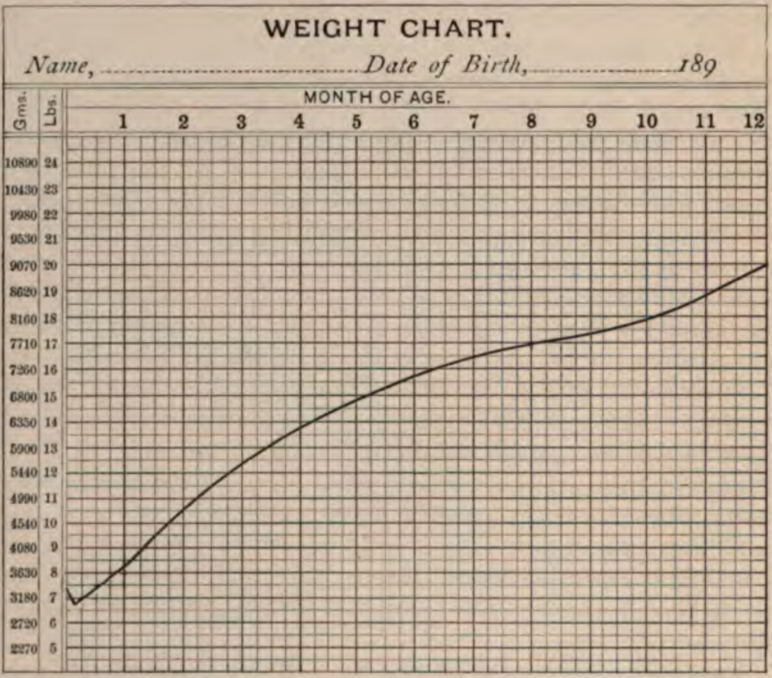

FIG. 6.—The weight curve of the first year.

At the end of the first year the average child weighs nearly three times as much as at birth. Perfect health during the first year is consistent only with a steady gain in weight. A child may not always gain rapidly, but it should gain steadily, and if it does not, something is wrong. All the conditions surrounding the infant should be investigated, but especially the food. One should not be satisfied unless the average weekly gain during the first six months is at least four ounces. In the second six months it may be slightly less. It may be taken as a rule that a child who gains regularly in weight is thriving; an exception must, however, be made in the case of some infants who are fed chiefly upon carbohydrate foods.

Weight from the Second to the Fifth Year.—Comparatively few observations have been published upon the weight during this period. From three hundred and seventy-two personal observations it appears that the gain is about six pounds during the second year, about four and a half during the third year, and about four pounds during the fourth year: the actual weights are given in the large table (page 20). During this period the gain is rarely steady even in the second year. With most children it is slowest or the weight is stationary in the summer months, while the most rapid increase is usually seen in autumn. Throughout this period the girls gain in about the same ratio as boys, but remain on the average nearly one pound lighter. During almost every illness, no matter of what character, the gain in weight ceases, and usually there is a loss, the rapidity and extent of which are somewhat proportionate to the severity of the attack; but it is always much more rapid in diseases of the digestive tract than in any other form of illness.

Weight of Older Children.—The weights given in the table of children from five to fourteen years are from Bowditch. Observations were made upon children of American parentage in the public schools of Boston—upon 4,327 boys and 3,681 girls.* It is to be remembered that these weights include the ordinary clothing, while those below five years are without clothing.†

The slowest gain is from the fifth to the eighth year, when it is about four pounds a year. From the eighth to the eleventh year it rises to about six pounds a year. Up to the eleventh year the two sexes gain in about the same ratio. From the eleventh to the thirteenth year the girls gain

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* W. T. Porter has published (1894) observations made upon 14,744 children of American parentage in the public schools of St. Louis. His figures show quite a variation from those of Bowditch, and are as follows:

AGE.	BOYS' WEIGHT.		GIRLS' WEIGHT.	
	Kilos.	Pounds.	Kilos.	Pounds.
6 years	19·66	43·2	18·76	41·3
7 "	21·67	47·7	20·82	45·8
8 "	23·91	52·6	22·71	50·0
9 "	26·08	57·4	25·07	55·1
10 "	28·49	62·7	27·43	60·3
11 "	31·26	68·8	29·93	65·8
12 "	33·45	73·6	33·17	73·0
13 "	35·96	79·1	38·29	84·2
14 "	40·34	88·7	43·12	94·9
15 "	47·25	103·9	46·90	103·2
16 "	52·10	114·6	50·06	110·1

† The average weight of the ordinary house clothing of school children, according to Bowditch, is at five years 2·8 pounds for both sexes; at seven years, 3·5 for both sexes; at ten years, 5·7 pounds for boys and 4·5 pounds for girls; at thirteen years, 7·4 pounds for boys and 5·6 pounds for girls; at sixteen years, 9·7 pounds for boys and 8·1 pounds for girls. This must be deducted from weights given to obtain the net weight.

much more rapidly, passing the boys for the first time and maintaining this lead until the fifteenth year, when again the boys pass them.

*Table showing Weight, Height, and Circumference of the Head and Chest from Birth to the Sixteenth Year.**

AGE.	Sex.	WEIGHT.		HEIGHT.		CHEST.		HEAD.	
		Pounds.	Kilos.	Inches.	Cm.	Inches.	Cm.	Inches.	Cm.
Birth........	**Boys.**	**7·55**	**3·43**	**20·6**	**52·5**	**13.4**	**34.2**	**13·9**	**35·5**
	Girls.	7·16	3·26	20·5	52·2	13·0	33·2	13·5	34·5
6 months	**Boys.**	**16·0**	**7·26**	**25·4**	**64·8**	**16·5**	**42·0**	**17·0**	**43·5**
	Girls.	15·5	7·03	25·0	63·6	16·1	41·0	16·6	42·2
12 months....	**Boys.**	**20·5**	**9·29**	**29·0**	**73·8**	**18·0**	**45·9**	**18·0**	**45·9**
	Girls.	19·8	8·84	28·7	73·2	17·4	44·4	17·6	44·6
18 months....	**Boys.**	**22·8**	**10·35**	**30·0**	**76·3**	**18·5**	**47·1**	**18·5**	**47·1**
	Girls.	22·0	9·98	29·7	75·6	18·0	45·9	18·0	45·9
2 years.......	**Boys.**	**26·5**	**12·02**	**32·5**	**82·8**	**19·0**	**48·4**	**18·9**	**48·2**
	Girls.	25·5	11·56	32·5	82·8	18·5	47·0	18·6	47·2
3 years.......	**Boys.**	**31·2**	**14·14**	**35·0**	**89·1**	**20·1**	**51·1**	**19·3**	**49·0**
	Girls.	30·0	13·60	35·0	89·1	19·8	50·5	19·0	48.4
4 years.......	**Boys.**	**35·0**	**15·87**	**38·0**	**96·7**	**20·7**	**52·8**	**19·7**	**50.3**
	Girls.	34·0	15·41	38·0	96·7	20·5	52·2	19·5	49.6
5 years.......	**Boys.**	**41·2**	**18·71**	**41·7**	**106·0**	**21·5**	**54·8**	**20·5**	**52.2**
	Girls.	39·8	18·06	41·4	105·3	21·0	53·5	20·2	51.3
6 years.......	**Boys.**	**45·1**	**20·48**	**44·1**	**112·0**	**23·2**	**59·1**	....	......
	Girls.	43·8	19·87	43·6	110·9	22·8	58·3	....	......
7 years.......	**Boys.**	**49·5**	**22·44**	**46·2**	**117·4**	**23·7**	**60·6**	....	......
	Girls.	48·0	21·78	45·9	116·7	23·3	59·5	....	......
8 years.......	**Boys.**	**54·5**	**24·70**	**48·2**	**122·3**	**24·4**	**62·2**	....	......
	Girls.	52·9	24·01	48·0	122·1	23·8	60·8	....	......
9 years.......	**Boys.**	**60·0**	**26·58**	**50·1**	**127·2**	**25·1**	**63·9**	....	......
	Girls.	57·5	26·10	49·6	126·0	24·5	62·5	....	......
10 years......	**Boys.**	**66·6**	**30·22**	**52·2**	**132·6**	**25·8**	**65·6**	**21·0**	**53·5**
	Girls.	64·1	29·07	51·8	131·5	24·7	63·0	20·7	52·8
11 years......	**Boys.**	**72·4**	**32·83**	**54·0**	**137·2**	**26·4**	**67·2**	....	......
	Girls.	70·3	31·87	53·8	136·6	25·8	65·8	....	......
12 years......	**Boys.**	**79·8**	**36·21**	**55·8**	**141·7**	**27·0**	**68·8**	....	......
	Girls.	81·4	36·90	57·1	145·2	26·8	68·3	....	......
13 years......	**Boys.**	**88·3**	**40·04**	**58·2**	**147·7**	**27·7**	**70·6**	....	......
	Girls.	91·2	41·36	58·7	149·2	28·0	71·3	....	......
14 years......	**Boys.**	**99·3**	**45·03**	**61·0**	**155·1**	**28·8**	**73·3**	....	......
	Girls.	100·3	45·50	60·3	153·2	29·2	74·1	....	......
15 years......	**Boys.**	**110·8**	**50·26**	**63·0**	**159·9**	**30·0**	**76·6**	**21·8**	**55·5**
	Girls.	108·4	49·17	61·4	155·9	30·3	76·8	21·5	54·8
16 years......	**Boys.**	**123·7**	**56·09**	**65·6**	**166·5**	**31·2**	**79·2**	....	......
	Girls.	113·0	51·24	61·7	156·7	30·8	78·8	....	......

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* The recently published observations of Boas (Science, April 12, 1895) upon 4,319 children over six years old show that first born exceed later children both in height and weight.

HEIGHT.

The figures showing the height at different ages are given in the foregoing table. The measurements of infants at birth are taken in about equal numbers from the records of the New York Infant Asylum and the Sloane Maternity Hospital. They were made upon full-term infants.

Average length of 231 males.................. 20·61 inches (52·5 cm.);
" " 211 females................. 20·47 " (52·2 ");
" " 442 infants.................. 20·54 " (52·35 ").

The most rapid gain in length is in the first year. During this period the child grows on an average a little over eight inches (21 cm.). This gain is usually, but not always, proportionate to the increase in weight. During the second year the average increase is three and a half inches (9 cm.). From this time on the rate of increase is quite uniform in both sexes until the eleventh year, it being between two and three inches a year.

After the eleventh year in girls and the twelfth in boys the growth is much more rapid. In height the girls exceed the boys at the twelfth and thirteenth years for the only time in their growth.

In the figures given in the preceding table those of five years and over are taken from Bowditch,* the observations being made upon the same children as those whose weights were taken. The observations from six months to four years inclusive are from original sources, and are drawn from about five hundred cases. The height much more than the weight of children is modified by hereditary influences.

Rachitic children during infancy and early childhood are, as a rule, shorter than others. I have frequently measured such children during the third year who were six inches below the average for that age. The effect of malnutrition upon the length of the body is much less than on the weight.

GROWTH OF THE EXTREMITIES AS COMPARED WITH THE TRUNK.

At birth the trunk is relatively long and the extremities short. Subsequently the growth of the extremities is much more rapid than that of the trunk. Thus I have found at birth the length of the lower extremities (measuring from the anterior superior spine of the ilium to the sole of the foot) to be forty-three per cent of the length of the body; at five years, fifty-four per cent, and at sixteen years sixty per cent. The above figures are from one hundred and fifty observations, which, although not numerous enough for exact percentages, are still sufficient to give a very good idea of the general relation of the length of the extremities to that of the body as a whole.

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* According to the observations of Porter, the St. Louis children reach a given height on the average about one year later than Boston school children.

THE HEAD.

Circumference.—The average circumference of the head at birth in four hundred and forty-six full-term infants taken in about equal numbers from the Sloane Maternity Hospital and New York Infant Asylum was as follows:

Average circumference of the head,	231 males..	13·90 inches	(35·5 cm.);
" " " "	215 females.	13·52 "	(34·5 ");
Total........................	446 infants.	13·71 "	(35·0 ").

The occipito-frontal measurement has been the one taken.

The growth of the head is most rapid during the first year, the increase being about four inches (10 cm.). During the second year the increase is about one inch (2·5 cm.). From the second to the fifth year the growth is slower, being only about one and a half inches (4 cm.) for the three years. After the fifth year the increase in the circumference of the head is very slow, as shown by the preceding table.

Closure of the Sutures.—The main sutures of the cranium are not commonly ossified before the end of the sixth month, and very frequently some mobility may be detected at the end of the ninth month. Distinct separation of the cranial bones after birth is abnormal. It is most frequently seen in premature and in syphilitic infants, but rarely in this country as the result of congenital rickets.

Closure of the Fontanels.—The posterior fontanel is usually obliterated by the end of the second month. The anterior fontanel under normal conditions closes on an average at about the eighteenth month. The usual variations are between the fourteenth and the twenty-second months. At the end of the first year the fontanel should be about one inch in diameter. An open fontanel at the end of the second year may always be considered abnormal. Rickets is the usual explanation.

The closure of the fontanel is not always early in well-nourished children, nor is it always delayed in those suffering from malnutrition. It often happens that in a child with marked evidences of malnutrition the fontanel at ten or twelve months is nearly or quite closed and the sutures firmly ossified. In such children the head is usually small, and the early closure is partly due to the slow growth of the brain. On the other hand, it is sometimes the case that in stout, well-nourished children the fontanel may remain open until nearly the end of the second year, although the child presents every evidence of perfect nutrition and no signs of rickets. This may be due to the fact that the brain has grown with more than usual rapidity. When, however, there is any great disproportion between the size of the head and the development of the rest of the body, or when the circumference of the head exceeds very much the figures given in the table above, either rickets or hydrocephalus should be suspected.

Shape of the Head.—The deformity which results from compression during labour usually disappears by the end of the first month. During the first year the head often becomes flattened at the occiput in consequence of the child's lying too much upon the back. This is easily remedied by changing its position. A slight obliquity of the head may be produced by the child's being habitually held in one position, as in some cases where it is nursed only at one breast, or where it is always laid upon the same side during sleep.

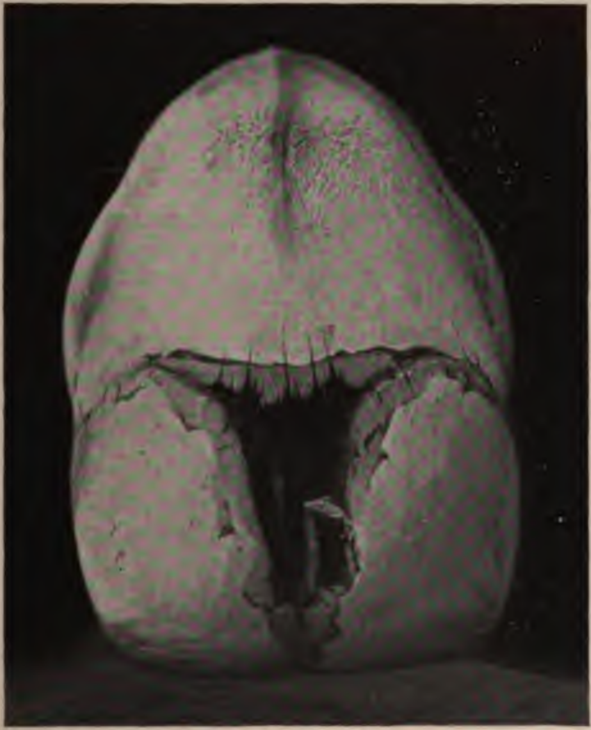

FIG. 7.—Premature ossification of the sagittal suture. Death at six weeks.

The other abnormities in the shape of the head are chiefly due to rickets and hydrocephalus, more rarely to congenital malformations of the brain. They will be considered in the chapter devoted to these topics.

Premature ossification of the sutures of the cranium occasionally gives rise to a very striking deformity of the head. I have recently seen two cases of such deformity from premature ossification of the sagittal suture. The heads in both cases were very narrow and long in the antero-posterior diameter. The forehead was narrow, prominent, and slightly projecting. The accompanying illustration shows the skull of one of these cases. There is a complete obliteration of the sagittal suture. In this case there was a wide separation of the sutures at the junction of the parietal and temporal bones. (See Fig. 7.)

THE CHEST.

The figures showing the circumference of the chest at the different periods of childhood are given on page 20. The measurements up to and including five years are from original sources, those from the sixth to the sixteenth are taken from Porter, and are drawn from observations on 31,371 school children. The measurement of the chest is that taken midway between full inspiration and expiration, and at the level of the nipples.

In the newly-born child the antero-posterior and the transverse diameters of the chest are nearly the same. As age advances, the transverse diameter increases very much more rapidly, so that the outline of the chest gradually assumes an elliptical shape, which it maintains during childhood.

At birth, the circumference of the chest is about one half inch less than that of the head, but throughout infancy the two measurements are nearly the same. It is not until the third year that the circumference of the chest exceeds that of the head. According to Uffelmann, the circumference of the head and the chest are the same until the twenty-first month in a robust child, and until two and a half years in an average child. If at three years the chest continues smaller than the head, the child is likely to be a weak one. If the chest is below the average at birth, it is likely to remain so throughout infancy. The chest measurement in infants is always much modified by the amount of fat; but, after making due allowance for this, a large chest always indicates a robust child and a small chest a delicate one. If at any age the circumference of the child's chest is found to be below the average, measures should be taken, by gymnastics and otherwise, to develop it.

Deformities of the thorax result chiefly from rickets, sometimes from empyema, emphysema, and cardiac disease; in older children, from lateral curvature of the spine, or from Pott's disease.

THE ABDOMEN.

Throughout infancy the circumference of the abdomen is, as a rule, about the same as that of the chest. At the end of the second year the measurements of the head, chest, and abdomen are very often identical; after this time the chest measurement increases much more rapidly than the other two. Marked enlargement of the abdomen is seen in many varieties of chronic intestinal disorders. It is, however, most marked in the tympanites which so constantly accompanies rickets.

MUSCULAR DEVELOPMENT.

The first voluntary movements are usually in the fourth month, when the infant deliberately attempts to grasp some object placed before it. During the fourth month, as a rule, the head can be held erect when the trunk is supported. In many infants this is possible in the early part of the third month. At seven months a healthy child is usually able to sit erect and support the trunk for several minutes.

In the ninth or tenth month are usually seen the first attempts to bear the weight upon the feet. At ten or eleven months a child stands with slight assistance. The first attempts at walking are commonly seen in the twelfth or thirteenth month. The average age at which children walk freely alone has been, in my experience, the fourteenth or fifteenth month. Quite wide variations are seen in healthy children. Very much depends upon the surroundings. I have known infants to walk at ten months and many others not until seventeen or eighteen months, although showing no evidences of disease, and although their development had not been retarded by previous illness. A very marked difference is seen in different families of children with respect to the time of walking.

The physician is often consulted because of backward muscular development, most frequently because the child is late in walking. General malnutrition, or any other severe or prolonged illness, may postpone for several months this or any of the other functions mentioned. When there is no such explanation of the backwardness, a child who does not hold up its head, sit alone, or make efforts to stand or walk at the proper time, should be submitted to a careful examination for a cerebral or spinal paralysis, but especially for rickets which is the most frequent explanation of the symptoms.

Contrivances for teaching infants to walk are unnecessary, and their effect may even be injurious. An infant should be allowed the greatest possible freedom in the use of its limbs. It should not be restrained from walking when inclined to do so, nor continually urged to walk when no voluntary attempts are made. Nothing short of mechanical restraint will prevent a healthy child from walking or standing when it is strong enough to do so.

DEVELOPMENT OF THE SPECIAL SENSES.*

Sight.—The newly-born infant avoids the light. Its pupils contract in a light room, and if a bright light is brought before the eyes they close. During the first few weeks the infant indicates by every sign that excessive light is unpleasant. As early as the sixth day the eyes will sometimes follow a light in the room, and the child may even turn the head for this purpose. The muscles of the eyes of the newly-born infant act irregularly and not in harmony. Co-ordinate action for general purposes is not established until about the end of the third month. Even after this time inco-ordinate action is occasionally seen. The eyelids also move irregularly, and are often partly separated during sleep. The cornea is but slightly sensitive during the first weeks. In Preyer's child it was not until the third month that the lids closed when the water in the bath touched the lashes or the cornea. The recognition of objects seen is usually evident in the sixth month.

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* For many of the facts in this paragraph I am indebted to Preyer's The Senses and the Will, American edition, 1888, D. Appleton & Co.

It is important that the room in which the newly-born child is placed should be darkened, and that for the first few weeks the eyes should be protected against strong light.

Hearing.—For the first twenty-four hours after birth infants are deaf. This deafness sometimes persists for several days. It is believed to be due to absence of air from the middle ear and to swelling of the mucous membrane which lines the tympanum. With the movements of respiration, air gradually finds its way into the middle ear, and the swelling subsides during the first few days. After this the hearing gradually improves, and during the early months of life it is very acute. The child starts at the slamming of a door, and even moderately loud noises will waken it from sleep. By the end of the second month it will sometimes turn its head in the direction from which the sound comes, and by the end of the third month this will usually be done. Demme found, in observations upon one hundred and fifty infants, that the voices of parents were recognised on an average at three and a half months.

Not only are the ears unusually sensitive to sound in infancy, but the impression produced upon the brain is often marked—very loud sounds causing great fright, and sometimes even, it is reported, convulsions.

Touch.—Tactile sensibility is present at birth, but is not highly developed except in the lips and tongue, where it is very acute for the obvious necessity of sucking. After the third month it is fairly acute over the surface of the body generally. Two especially sensitive areas, according to Preyer, are the forehead and external auditory meatus.

Sensibility to painful impressions is present in early infancy, but very dull as compared with later childhood.

Temperature is also distinguished. This recognition is especially acute in the tongue. A young infant is often seen to refuse to take the bottle because the milk is only a few degrees too cold or too warm.

The localization of sensory impressions comes later, probably not much before the middle of the sixth month, and is very imperfect throughout the first year.

Taste.—This is highly developed, even from birth. According to the experiments of Kussmaul, the ability to distinguish sweet, sour and bitter, exists in the newly-born child—sweet exciting sucking movements, and bitter, grimaces. A young infant detects with surprising accuracy the slightest variation in the taste of its food, and the smallest difference is often enough to cause it to refuse its bottle altogether. Sweet substances are always easily administered, and in combination with sirups even very bitter substances can be given; but to aromatic powders and elixirs it usually objects.

Smell.—Observations upon the sense of smell in newly-born infants are few and not altogether conclusive. Kroner's experiments appear to show that smell is present in the newly born. It has been noted to be especially acute in infants born blind. The sense of smell is developed much later than the other senses. Detection of fine differences in odours is not acquired until quite late in childhood.

SPEECH.

There is a very wide variation in children with reference to the time of development of the function of speech. Girls, as a rule, talk from two to four months earlier than boys. Towards the end of the first year the average child begins with the words "papa," "mamma." By the end of the second year it is able to put words together in short sentences of two or three words. Progress in speech from this time is very rapid, each month showing great improvement. Names of persons are commonly first acquired, then the names of objects. Next to this the verbs are learned, and then adverbs and adjectives. Conjunctions, prepositions, and articles follow in order, and last of all the personal pronouns.

If a child of two years makes no attempt to speak, some mental defect may usually be inferred.

DENTITION.

The teeth are enclosed at birth in dental sacs which are situated in the gums. Above, they are covered by the submucous connective tissue and the mucous membrane; below, the dental sacs rest in depressions in the alveolar process of the jaw. The tooth grows in length mainly as the result of the calcification of its roots, and being thus fixed below, it pushes upward towards the mucous membrane. This growth undoubtedly goes on steadily from birth until the tooth pierces the gum.

The deciduous or milk teeth are twenty in number. The time at which they appear is subject to considerable variation even under normal conditions. The following is the order and the average time of appearance of the different teeth:

(1) Two lower central incisors	6 to 9 months.
(2) Four upper incisors	8 " 12 "
(3) Two lower lateral incisors and four anterior molars.	12 " 15 "
(4) Four canines	18 " 24 "
(5) Four posterior molars	24 " 30 "

At 1 year a child should have	6 teeth.
At 1½ " " " "	12 "
At 2 years " " "	16 "
At 2½ " " " "	20 "

Quite wide variations on both sides of the average are common, and are not always easy of explanation. In many cases it seems to be a family idiosyncrasy, since in the different members of a family the teeth are apt to appear at about the same time. I know one family in which no less than three members of three successive generations were born with teeth, and in most of the other members the first teeth appeared in the third or fourth month. The order in which the teeth appear is much more regular than the time of their appearance. The order given above corresponds with that stated by most observers, although some writers have made different statements, placing the lower before the upper lateral incisors.

The teeth may pierce the gum without any local manifestations. Very frequently, however, just before a tooth comes through there is noticed a moderate swelling and redness of the mucous membrane of the gum overlying it, and to a slight degree this may affect the general mucous membrane of the mouth. This condition may be accompanied by a little fretfulness and increased salivation, or both of these may be entirely wanting. These symptoms usually disappear when the tooth has pierced the gum. The symptoms of difficult dentition will be discussed in connection with Diseases of the Mouth.

Infants may be born with teeth; this is, however, an exceedingly rare occurrence. It is almost invariably one of the lower central incisors that is present. In case this interferes with nursing, or if it is very loosely attached to the gum, it should be extracted, but under other circumstances it should be allowed to remain, since, if it is removed, a second tooth is not likely to appear in its place in the first set. It is not at all uncommon for the first teeth to appear in the fourth month. Such teeth, in my experience, do not usually differ in character from those appearing later, unless they are in children who are syphilitic. Syphilitic children are rather prone to early dentition, and under such circumstances rapid and early decay is likely to take place. Nursing infants are, as a rule, a little earlier in their dentition than those artificially fed.

Delayed dentition is much more frequently due to rickets than to all other causes combined. It is to be remembered, however, that the first teeth may not appear until the tenth month in healthy, well-nourished children and in those who present no signs whatever of rickets. On the other hand, it is by no means invariable that dentition is late in rachitic children. The latest dentition is seen in cases of cretinism. In such children it is not rare for the first teeth to appear as late as the eighteenth month. I have seen one child two years old with but two teeth. As a rule, dentition and ossification of the bones of the head go on in a corresponding manner; where one is early the other is likely to be rapid, and conversely.

Provided an infant is well nourished and thrives properly for the first six or eight months, the eruption of the teeth is likely to go on steadily after this time, even though the child may later have chronic indigestion or suffer from extreme malnutrition from any cause excepting rickets. If, however, the symptoms of malnutrition date from birth, dentition is almost invariably delayed. It is often a matter of very great surprise to see children who are markedly emaciated as a result of chronic indigestion or ileo-colitis and yet go on cutting their teeth regularly. I have under observation at the present time a delicate infant of sixteen months, whose body length is twenty-eight inches and whose weight is less than nineteen pounds—almost exactly what they were eight months ago—and yet he has now thirteen good teeth.

Eruption of the Permanent Teeth.—The first to appear are the first molars, which usually come in the sixth year, and hence the name six-year-old molars, which is applied to them. These appear posterior to the second molars of the first set. The following table from Forchheimer gives the average time of the appearance of the second teeth:

First molars	6	years.
Incisors	7 to 8	"
Bicuspids	9 " 10	"
Canines	12 " 14	"
Second molars	12 " 15	"
Third molars	17 " 25	"

The order of appearance, therefore, leaving out the first molars, is essentially the same as that of the first set. The permanent teeth, with the exception of the molars, take the place of the corresponding deciduous teeth. As they grow and push upward they cause atrophy of the roots of the first teeth, and gradually cut off their blood supply, so that they loosen and fall out.

The place of dentition as an etiological factor in the diseases of infancy will be considered in the chapter on Difficult Dentition.

CHAPTER III.

PECULIARITIES OF DISEASE IN CHILDREN.

In many particulars disease in children differs from that of later life. These differences relate to etiology, pathology, symptomatology, diagnosis, and prognosis. The greatest contrast to adult life is presented by infancy and early childhood. After seven years, children in their diseases resemble adults more than they do infants.

ETIOLOGY.

1. **Inheritance** is an important factor. The disease most frequently transmitted directly is syphilis. Occasionally tuberculosis and other infectious diseases have been conveyed directly from the mother to the child. In cases where no distinct disease is transmitted, children may inherit from parents constitutional tendencies, or a diathesis which may manifest itself in infancy, or in some cases not until later childhood. Under this head we may place the influence of rheumatism, gout, the various neuroses, and possibly alcoholism and insanity. In consequence of these conditions in parents, the child may inherit no definite disease, but simply a vitiated constitution.

2. **Malformations** must be considered, particularly in the first two years of life. The most important of these, from a medical standpoint, are those of the heart, brain, and kidney. The various malformations of the mouth, nose, bladder, rectum, and genital organs belong more particularly to the domain of surgery.

3. **The Diseases or Accidents Connected with Birth.**—Some of these are distinctly traumatic, like the meningeal hæmorrhages. A very large class are the infectious processes in the newly born. Infection usually takes place through the umbilical wound, more rarely through the skin or mucous membranes. This class includes pyæmia, with its varied lesions in the brain, lungs, and serous membranes, erysipelas, ophthalmia, and tetanus. In the class of infectious diseases may also be included many of the varieties of pulmonary and intestinal diseases in the newly born, and probably also some of the hæmorrhagic affections.

4. **Conditions Interfering with Proper Growth and Development.**—These are among the largest etiological factors in the diseases of infancy. They are improper food or feeding, unhygienic surroundings, and neglect.

These may cause specific diseases, like rickets or scurvy, or may lead to a condition of general malnutrition or marasmus. In this way they become most important predisposing factors, in infancy, to the acute diseases of the gastro-enteric tract, and later in childhood, to functional nervous diseases.

5. **Infection.**—This has already been mentioned as an important factor in diseases of the newly born. The number of diseases in later life directly traceable to this is very large, and is constantly increasing. Under this head should be included not only the well-known classes of infectious and contagious diseases, but also a very large number of varieties of infection which as yet have not been differentiated, and the nature of which is but imperfectly understood.

SYMPTOMATOLOGY AND DIAGNOSIS.

In older children the symptoms of disease are very much the same as in adults, and similar methods of examination may be employed. What is really peculiar to children belongs especially to the first three years of life, before speech has developed. During this period the chief and almost the sole reliance of the physician must be upon the objective signs of the disease. It is not so much that diseases in early life are peculiar, as that the patients themselves are peculiar.

Two fundamental facts are always to be kept in mind: First, that the common pathological processes are comparatively few, being chiefly of the gastro-enteric tract, the lungs, and the brain, but that the variations in clinical types are almost endless; the second is, that in infants, on account of the susceptibility of the nervous system, functional derangements are often accompanied by very grave symptoms, and may even prove fatal in twelve or twenty-four hours, or there may be speedy and complete recovery after very alarming symptoms. In many of these cases the symptoms are so indefinite that an exact diagnosis is impossible during life, and even the autopsy may throw but little light upon them.

At the bedside, it is of great assistance to the physician if he can keep in mind the most frequent forms of acute disease that are likely to be met with. In the first group, including those which are very common, may be placed acute indigestion and ileo-colitis, bronchitis, pneumonia, pharyngitis, and tonsilitis; in the second group, including those which are not quite so common, may be placed otitis and the acute infectious diseases—measles, scarlet fever, diphtheria, influenza, and malaria; in the third group, including the rarer forms of acute disease—meningitis, tuberculosis, rheumatism, and diseases of the kidneys. Under all circumstances, the season, and the nature of the prevailing epidemic, if one exists, are to be considered.

In the examination of a sick infant quite a different method is to be followed from that pursued in adults. Much information is to be gained from a history carefully taken from an intelligent mother or nurse, and much more from a close observation of the child, whether asleep or awake, quiet or crying.

The History.—The points to be most carefully investigated will vary somewhat with the nature of the illness. If the disturbance is one of nutrition, the minutest details relating to the character and preparation of the food from birth up to the present illness must be considered; also the progress of dentition, and whether this has been easy or difficult. All facts relating to the child's growth and development are significant—the period when it was able to sit alone, stand and walk, and its weight. Every previous illness should be investigated as to its nature, duration, and severity, especially the eruptive fevers, the diseases of the lungs and the digestive tract. All the facts relating to the present illness should then be brought out—the exact time and mode of onset, the presence or absence of fever, the amount of food taken, the existence of cough or hoarseness, the evidences of pain, such as restlessness or screaming, the character of the sleep, the condition of the bowels, the amount of urine passed, and the frequency of micturition. In every case the physician should inspect for himself the child's napkins, and never trust to the statements of the mother or nurse with regard to the character of the fæcal discharges or the urine. The question of exposure to any contagious disease should also be considered.

In chronic diseases it is of special importance to investigate the subject of heredity, from manifestations of disease both in the parents and in other children of the family. This is most important with reference to syphilis and tuberculosis. The character of the labour should be inquired into, whether it was difficult, prolonged, or instrumental.

Inspection.—What is learned by the inspection of a sick child will depend almost entirely upon the powers of observation of the physician. One accustomed to bring out the patient's symptoms by questions is dedecidly at a loss to know how to proceed in the case of a sick infant. With time, patience and method very much that is important and exact can be determined. In fact, the diagnosis of disease in infancy, instead of being, as is often supposed, a matter of extreme difficulty or impossibility, becomes with experience quite as easy as among adults.

In acute disease when the child is asleep or quiet the following points should be noted:

1. *Posture*—whether the child lies upon the back, the side, or the face; whether there is opisthotonos, or a general flexion of all the limbs.

2. Character of the *sleep*—whether it is quiet and peaceful or disturbed; whether there is constant tossing about, grinding of the teeth, etc.

3. *Respiration*—whether it is regular, or irregular. This can be determined only by careful observation for some minutes. It should be noted

whether it is rapid, or slow, easy, natural, and quiet, or whether there is nasal obstruction with snoring and mouth-breathing due to tonsillitis, diphtheria, scarlet fever, or adenoid vegetations of the pharynx. The best evidence of dyspnœa is the recession of the supraclavicular and suprasternal regions, the sinking in of the intercostal spaces, sometimes with lateral recession of the chest walls. There is usually present active dilatation of the nostrils.

4. *Pulse*—whether it is rapid or slow, full and strong or soft and compressible. The frequency of the pulse in infancy is of much less importance than the force and rhythm. A slow, irregular pulse is always significant, and should suggest meningitis; an irregular pulse, when rapid, has no special significance.

5. *Skin*—whether it is dry and hot, or covered with perspiration. The existence of pallor, general cyanosis, or blueness of the lips and finger nails should be noted; also the circulation in the extremities, whether they are warm, or cold and clammy.

6. *Facial expression*—whether this is calm and peaceful, drawn and anxious, intelligent or stupid, and whether the features are contracted from time to time as if from pain.

7. *Cough*—whether this is frequent, difficult, or severe.

8. *Cry:* Since this is the chief means by which the infant expresses discomfort or displeasure, it becomes exceedingly important but not always easy to determine whether an infant cries from pain, discomfort, hunger, temper, or from habit. In very many instances the cry under these conditions is so characteristic that one who is familiar with the child's language readily divines what is wrong. It is something which should never be disregarded, even though it may be the only obvious symptom. Tears are not seen until the second month, so that their absence before that time is not to be taken as an evidence that the cry is not from pain.

The cry of hunger is apt to be interrupted by vigorous sucking of the fingers. It is not usually sharp and piercing, like the cry of pain, but it is a worrying, fretful cry. It ceases immediately when the hunger has been satisfied.

The cry of indigestion is often mistaken for that of hunger, but in such cases, although crying may cease for a few minutes after taking food, from the temporary relief which this gives, it is likely soon to return with unabated vigour. Under such circumstances a frequent repetition of feeding or nursing should never be allowed, although very often this is just what is done.

The character of the cry of pain will depend somewhat upon the severity of the pain. When it is acute like that of colic or earache, it may be sharp and piercing, and accompanied by contraction of the features, drawing up of the legs, and other evident signs of distress. The child falls asleep only when exhausted, and soon wakes, often with a scream. In pain of less severity there is usually moaning, but rarely a sharp cry. Infants cry not only from pain but from every sort of discomfort—wet diapers, cold feet, a cramped position, uncomfortable clothing, also if they are tired or sleepy, and from a great many other minor causes. The more delicate a child the more readily it cries from any cause.

The cry of weakness and exhaustion is quite characteristic. It may be noticed in a great variety of conditions. It is usually a low, feeble whine or moan, often nearly constant, except when the child is asleep.

The cry of temper is not generally heard before the fifth month. It is usually accompanied by stiffening of the body, throwing back of the head, and sometimes by vigorous kicking. It is loud, violent, and often prolonged.

The cry of habit is one of the most difficult to recognise. These habits are formed by indulging infants in various ways. Some children cry to be held, some to be carried, some to be rocked, some for a light in the nursery, some for a rubber nipple or some other thing to suck. The extent to which this kind of crying may be indulged in, even by very young infants, is surprising, and it explains much of the crying of early childhood.* The fact that the cry ceases immediately when the child gets what it wants is diagnostic of the cry from habit. The only successful treatment of such cases is to allow the child to "cry it out" once or twice, and then the habit is broken. Of course, before such a procedure is allowed to go on, one must be well assured that the cry is from this cause and no other.

There are some diseases in which the cry is sufficiently characteristic to be of diagnostic importance. Thus we hear the short, catchy, suppressed cry of pneumonia, the sharp nocturnal cry of tuberculous meningitis and of chronic bone disease, the moan of chronic indigestion and acute intestinal diseases, the hoarse nasal cry of hereditary syphilis, and the feeble whine of marasmus and of atelectasis.

9. The *mental condition* may be one of undue excitement, and it may be difficult to tell whether this is from fright at the approach of a stranger

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* On admission to the Babies' Hospital very young infants almost invariably cry a great deal for the first two days. It being against the rules to take such children from their cribs and hold them to quiet their crying, they soon cease the habit, and give no further trouble, crying subsequently only from the usual causes.

Dr. J. S. Thacher relates an experience which illustrates to what extent this habit may be formed in infants of only a few weeks. In a hospital ward under his care, containing fifteen or twenty mothers and newly-born infants, one of the women was seriously ill, and was so annoyed by the crying of the infants that they were allowed to be taken from their cribs and held or carried as soon as crying from any cause began. After several days the patient was removed from the ward, and for the next two or three days the crying in the ward was enough to drive one distracted; but the mothers were forbidden to quiet the infants by taking them up, and after two or three days' discipline the crying ceased and peace and order were again restored.

or from disease. More significant is a condition of apathy and dulness and general relaxation in which no resistance whatever is made to the examination. Such symptoms always indicate either extreme prostration or brain disease. A child may cry from pain or from fright. General hyperæsthesia is common in meningitis. Soreness of the legs only, suggests scurvy, rheumatism, or joint disease.

10. The condition of the *pupils* should be observed, whether contracted or dilated, and the nature of the response to light; also the presence of corneal ulcers and the interstitial keratitis so frequent in hereditary syphilis. The thin mucous film seen over the cornea always indicates grave prostration, and often approaching death.

11. The *lymph glands* of the neck should be noted: as when swollen they may indicate scarlet fever, diphtheria, or simple acute inflammation.

12. The presence or absence of *nasal discharge* should be determined, and also, if possible, its character. In acute disease this suggests diphtheria, scarlet fever, or influenza; if it is chronic, adenoid growths of the pharynx, or syphilis.

13. The appearance of the *mucous membrane of the mouth*, *teeth*, and *gums* may often be ascertained by watching the child while it is crying. It should be noted whether the tongue is dry or moist, also whether thrush is present, or any other form of stomatitis. The condition of the gums may be observed, whether congested or swollen or hæmorrhagic as in scurvy, and also the number, position, and character of the teeth. The general colour of the mucous membrane may be significant, as in cases of cyanosis.

Very much can be learned in acute illness by simply watching attentively a sick child for a few minutes, studying the foregoing points in order. By such observation and a carefully obtained history of the illness an experienced physician can often make a very probable diagnosis without further examination; the latter, however, should never be omitted.

The Physical Examination.—*Temperature.* The first step should generally be to ascertain whether or not there is fever. For this one should never fall into the habit of trusting to his sense of touch, for it is often very misleading. Only the rectal temperature in infants is to be depended upon, since axillary temperatures are untrustworthy, and those in the mouth difficult to obtain.

Immediately after birth the temperature of the child is about the same as that of the mother, or a little higher. It falls from 1° to 3° F. in the course of the first few hours, under the influence of the bath and radiation from the skin during dressing. Very soon it again rises to 98·5° or 99° F., near which point, under normal conditions, it remains during the first months of life, and in fact throughout childhood.

From a large number of personal observations upon healthy infants I have found the rectal temperature to vary, under normal conditions, between 98° and 99·5° F. Within these limits the temperature may be considered normal. The heat-regulating center in the brain acts only imperfectly in the young infant, and very slight causes are enough to disturb the temperature. When the heat equilibrium has once been disturbed, slight fluctuations may continue for some time after the cause has been removed.

The temperature in infants is always higher than from corresponding causes in adults. Moreover, very high temperatures may be met with in cases not at all serious, and not infrequently when no explanation can be found even after the most thorough examination. In such cases the temperature very often does not remain at a high point for more than a few hours. It is a continuous high temperature rather than a single rise which is significant of disease in infancy. Nothing is more perplexing to the young practitioner than the frequency with which a high temperature is seen in infants in cases of comparatively mild illness. While a valuable guide in diagnosis, the temperature alone must not be depended upon in early life, nor should its significance be measured by the adult standards.

It is very common in chronic wasting diseases, in delicate infants and in those prematurely born, to find the temperature one or two degrees below the normal; 95° and 96° F. are of almost daily occurrence in hospitals. In one premature infant the temperature on admission was 93° F. The feeble heat-producing power of these infants, and the rapid radiation from their bodies because of the absence of subcutaneous fat, make the temperature a very important matter in their nutrition. Daily observations should be made with the thermometer, just as in cases of high temperature.

Some of the most puzzling elevations of temperature met with in infancy are the result of the application of artificial heat. Erőss has shown by very careful experiments that the body temperature can be raised by means of hot bottles or water bags from 1° to 5° F. This is accomplished much more readily in the case of feeble or delicate infants than in those who are stronger. The truth of his observations I have had abundant opportunity to verify in my own experience. This cause must be carefully eliminated in cases where unusually high temperatures appear after surgical operations or unexpectedly under other conditions.

For the purpose of making a systematic routine examination of the entire body, the child's clothing, with the exception of the napkin, should be removed, and the child laid upon the nurse's lap on a blanket. The *skin* may now be inspected for eruptions, and it is important that the entire body be examined. Next the general nutrition of the patient should be observed—whether it is emaciated or well nourished.

The *head* should be examined to see whether the sutures are ossified or unnaturally open; whether the fontanel has closed, or, if open, whether it is depressed or bulging.

The details regarding physical examination of the *lungs* are discussed in the introductory chapter of the section devoted to pulmonary diseases.

In the auscultation of the *heart*, it should be remembered that under two years of age loud murmurs are almost invariably of congenital origin, that soft murmurs are frequently functional, and that acquired organic heart disease is extremely rare until after the third year.

In the examination of the *abdomen* there should be noted the presence or absence of tympanites or abdominal tenderness, whether general or localized, and the existence of retraction of the abdominal walls as in meningitis. The size and position of the liver and spleen are best determined by palpation. The lower border of the liver is usually slightly below the free border of the ribs. If the spleen can be easily felt below the ribs, it is as a rule enlarged. If it can not be felt in a satisfactory examination, it is not sufficiently enlarged to be of any diagnostic importance. It should be remembered that both liver and spleen may be displaced downward in rickets from contraction of the chest, giving the appearance of slight enlargement when they are normal in size. In acute disease a large spleen suggests malaria, typhoid, or tuberculosis; in chronic disease, malaria, syphilis, leucæmia, or anæmia.

Examination of the *urine* should not be forgotten. The staining of the napkin may give information regarding the discharge of crystalline uric acid or of concentrated urine. For other purposes the urine must be collected. This is often difficult. The most satisfactory method I have found is, in male infants, to tie a condom over the penis; in female infants, to put a small cup over the vulva inside the napkin. In those who are a year old the urine may readily be collected by putting the child upon the chamber every few minutes. It is important not to overlook phimosis or balanitis in the male or vulvo-vaginitis in the female, since these conditions may not only give rise to local but even to general symptoms.

A careful inspection of the *throat* should never be omitted in any acute illness, no matter what the other symptoms are; but usually this had better be deferred until the last. For this are required a good light and a quick glance. Upon the hard palate one may look for the first signs of the eruption in measles and scarlet fever, and the condition of the throat may be the first and one of the most important signs of both the diseases. Diphtheria may exist without pseudo-membrane, and marked general redness may be due to scarlet fever, influenza, or simple pharyngitis.

In chronic disease a somewhat different method of examination may be followed. The most important diseases because most often met with in infancy are, in the first place, those which are connected with nutrition, chronic disturbances of the gastro-enteric tract, rickets, and scurvy; secondly, syphilis, tuberculosis, chronic diseases of the lungs, diseases of the blood, the bones, the kidney, and the heart.

In the examination, the general development of the child should be considered. Its height, weight, circumference of head, chest, and abdomen should be taken and these compared with the average for the child's age. The condition of the tissues should be noted, whether firm, soft, or flabby; the ligaments, whether relaxed or not; the presence of bony deformities; also the existence of pallor, cyanosis, and cachexia, and the general nutrition. It should then be determined whether the child has for its age a sufficient muscular development, as shown by sitting, standing or walking. Its speech, hearing, sight, general intelligence and, finally, its mental disposition should be investigated.

In the local examination special attention should be given to the shape of the skull, the condition of the sutures, the size and shape of the fontanel, and the progress of dentition. It should be noted whether there are glandular swellings in the neck or in different parts of the body; also hypertrophied tonsils or adenoids. Finally, there should follow a thorough examination of the heart, lungs, liver, spleen, blood, urine, bones, spine, and joints. The same order need not be followed in every case, but the examination should always be thorough, and with the body stripped. Unless this is done, serious deformities are often entirely overlooked, and an erroneous diagnosis made.

In children who are old enough to answer questions the same method may be pursued as in an adult examination. An important thing in dealing with children is a gradual approach, first winning the confidence of the child and diverting its attention from the real purpose in view; secondly, the avoidance of every rough examination which might by any chance produce pain; and, finally, deferring until the end of the examination the inspection of the throat, which must frequently be done forcibly, and is sure to interrupt any further chance of intimacy. With time and patience almost everything mentioned in the above category can be satisfactorily investigated.

PATHOLOGY.

The pathological processes which result from intra-uterine disease and those which are connected with delivery are peculiar to early life. They have already been referred to in the section on etiology. Of the processes of early life which begin after birth, the first in frequency are those of the mucous membranes resulting from the various forms of infection. In summer, it is the stomach and intestines which suffer chiefly; in winter, the respiratory tract.

The serous membranes are rarely the seat of primary inflammation. The pleura is seldom the seat of primary disease, but very often involved secondarily to disease of the lung itself. Affections of the pericardium and peritonæum are quite rare. Meningitis is fairly common both in the simple and the tuberculous form.

Diseases of the lymph nodes (lymphatic glands) play an important part in connection with the acute diseases of the mucous membranes, with many affections of the skin and even of the viscera. Acute infection tends to excite suppurative inflammation, particularly in infants; a less active process leads to chronic hyperplasia in the mesenteric, mediastinal, and cervical glands, in the tonsils, adenoid tissue of the pharynx, etc. The lymph nodes in the neck and thorax are frequently the earliest seat of tuberculous deposits, and in very many cases they are the foci from which secondary infection of the lungs, brain, or joints may occur.

Of the visceral inflammations* those of the lungs are the most com-

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* The following table gives in a general way a very good idea of the relative frequency of diseases of the different organs in infancy. It is based upon seven hundred and twenty-six consecutive autopsies in the New York Infant Asylum, extending over a period of eight years during my connection with that institution. More than one half of the autopsies I made personally. Of these children seventy-two per cent were under one year, twenty-five per cent between one and two years, and only three per cent were over two years. The institution does not receive infants under one month, hence the absence of lesions peculiar to the newly born:

Table showing principal lesions in seven hundred and twenty-six consecutive autopsies in the New York Infant Asylum.

Lungs:			
	Pneumonia—	Primary	139
		Complicating other acute infectious diseases	112
		Complicating other conditions	71
		Noted to be present in	322
	Pleurisy—	No case uncomplicated with disease of lungs.	
		Empyema	5
		Serous pleurisy	1
		Dry pleurisy in nearly all the severe cases of pneumonia.	
	Atelectasis (congenital)		6
	Pulmonary abscess (always with pneumonia)		7
	Pulmonary gangrene (always with pneumonia)		2
	Pulmonary tuberculosis		56
Mouth:			
	Noma		1
Peritonæum:			
	Acute peritonitis (localized 2, with acute pneumonia and pleurisy 2)		4
Kidneys:			
	Acute nephritis (complicating scarlet fever 4, diphtheria 1, pneumonia 4, measles 1, pertussis 1, ileo-colitis 2, pyonephrosis 1, apparently primary 5)		19
	Malformations of the kidney		7

mon, it being rare to find the lungs normal at autopsy after any acute infectious disease which has lasted a week. Up to the third or fourth year of life the heart usually escapes. In older children it may be involved, as in adults, in the rheumatic diseases. The liver and spleen are not often the seat of organic disease in early life, nor is serious disease of the kidney likely to be met with excepting in connection with scarlet fever. Organic disease of the brain itself is rare, as is also organic disease of the spinal cord, with the exception of poliomyelitis. Chronic diseases of the different viscera are decidedly rare, except when resulting from acute processes. Diseases of the bones and joints are common, and of extreme importance. They are usually of tuberculous, less frequently of syphilitic, origin. Diseases of the blood are quite common, but as yet but little understood. New growths are rare. The parts most frequently the seat are the kidney and the bones. Disorders of nutrition are extremely common and of great importance, particularly rickets and scurvy.

PROGNOSIS AND INFANT MORTALITY.

The younger the patient the worse the prognosis in all the diseases of childhood. This is in consequence of the feeble resistance of the infantile organism to all diseases, particularly those which are of an acute nature. On the other hand, the rapid metabolism of childhood makes it possible for many conditions of an organic nature to disappear with time, or, as the phrase is, to be "outgrown," provided the patient can be so placed that the general nutrition can be carried to the highest point.

The accompanying chart (Plate I) shows the mortality of New York city by months during the three years from 1890 to 1892, inclusive,

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Stomach and Intestines:	
Acute ileo-colitis, with or without gastritis	116
Acute gastritis (without intestinal lesions)	None
Acute diarrhœal disease (without gross lesions)	72
Intussusception	1
Heart:	
Pericarditis (all with acute pneumonia)	8
Congenital malformations	3
Acute or chronic endocarditis	None
Brain:	
Acute, simple, or purulent meningitis (7 with pneumonia, 2 cerebro-spinal)	14
Tuberculous meningitis	11
Acute encephalitis	1
Chronic pachymeningitis	5
Chronic simple meningitis	1
Chronic hydrocephalus	3

There were twenty-six deaths from marasmus without gross lesions.

PLATE I.

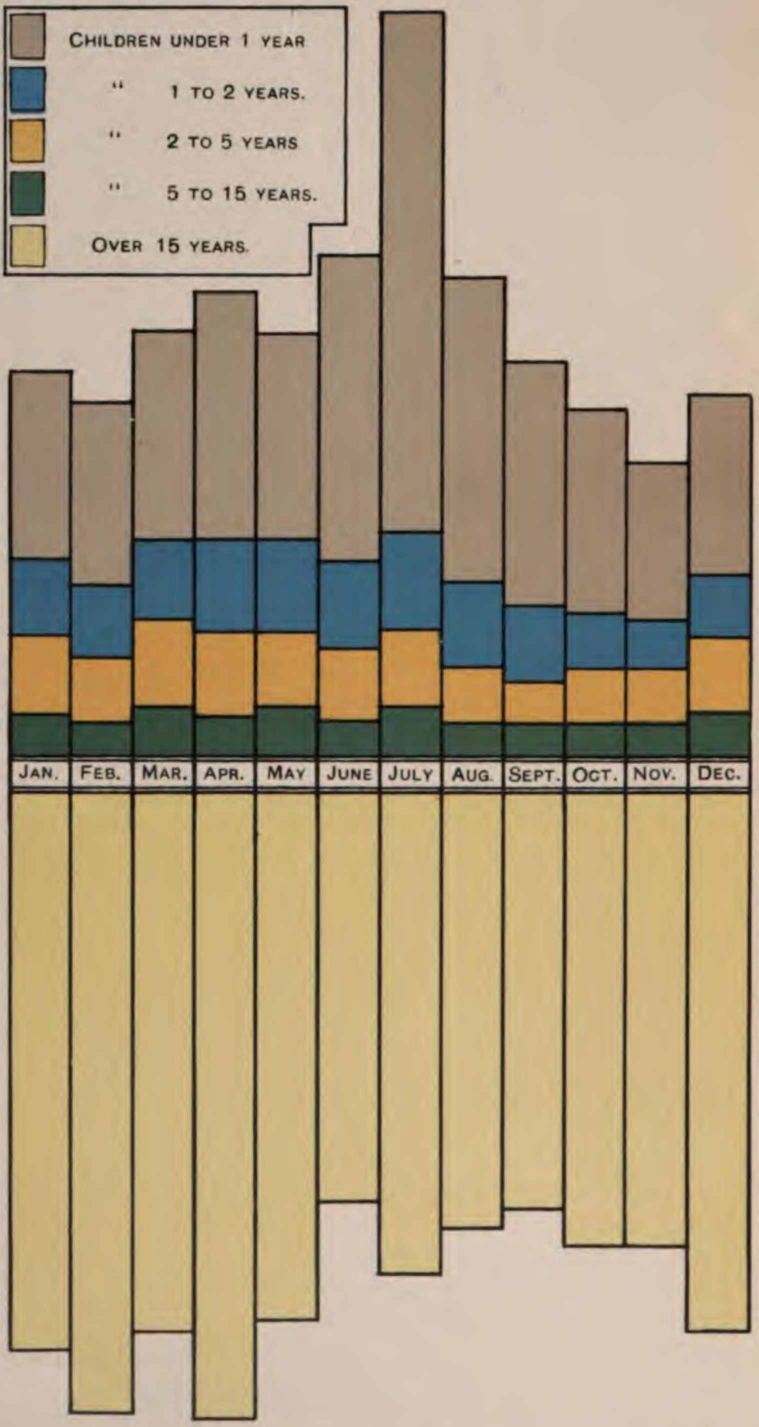

Chart showing by months the mortality of New York city for the different ages for three years. (Scale, 1 in. = 2,200 deaths.)

representing a total mortality of 128,136. This is distributed among the different ages as follows:

Under 1 year	32,916	= 26 per cent.
1 to 2 years	10,547	= 8 "
2 to 5 "	9,794	= 7 "
5 to 15 "	5,470	= 5 "
Over 15 "	69,409	= 54 "
	128,136	

Thus over one fourth of all the deaths occurred during the first year of life, and over one third in the first two years. The graphic chart gives a better idea of this than the figures. It will be noticed that the only age in which the mortality is much increased in the summer months is in the first year.

According to Eröss, who collected statistics from sixteen cities of continental Europe, of 1,439,056 infants born, there died in the first four weeks of life 130,610, or nearly ten per cent.

The Most Frequent Causes of Death at the Different Periods of Childhood.—According to Eröss, of 94,400 deaths occurring during the first four weeks, fifty-six per cent were due to congenital debility. The other causes which raise the mortality in this period are asphyxia, infection, congenital malformations of the heart, intestine, or genito-urinary tract, hæmorrhages, convulsions, acute attacks of diarrhœal diseases, and pneumonia. Pneumonia is exceedingly common in very young infants, both as a primary and secondary lesion.

Statistics from America and Europe show that in all large cities infant mortality has been steadily increasing for the past twenty-five years. This is due to many causes—overcrowding, neglect, and unhygienic surroundings. But more important than all is artificial feeding as at present ignorantly practised. In my experience it is exceedingly rare to find a healthy child who has been reared in a tenement house, and who has been artificially fed from birth. While among the poor the capacity for maternal nursing seems to be diminishing year by year, among the better classes it has come to be the exception and not the rule. In my private practice not one third of the mothers have been able, even though willing, to nurse their infants. But as ignorant and improper feeding are not confined to the poor, we find among rich and poor alike the largest number of deaths in the first year due to disease of the gastro-enteric tract and marasmus, either alone or associated. In the second rank come acute diseases of the respiratory tract, especially acute broncho-pneumonia. All other causes of mortality fall far below these two. Of the nervous diseases, convulsions and tuberculous meningitis are the only ones that are common. Of the acute infectious diseases pertussis takes the first place, with measles second, while tuberculosis ranks first of the chronic infec-tions. Although rarely the cause of death, rickets is a very important factor in increasing the mortality of other diseases.

During the second year the deaths from marasmus are few. The diseases of the gastro-enteric tract are still a large factor in the death rate, but by no means to so great a degree as in the first year of life. Nearly if not quite as important during this period are the acute diseases of the lungs and the acute infectious diseases, especially measles, diphtheria, and pertussis. Deaths from scarlet fever are much less numerous. General tuberculosis and tuberculous meningitis are frequent.

From the second to the fifth year the deaths are mainly from acute infectious diseases—chiefly diphtheria and scarlet fever—much less frequently from measles or pertussis. In the next group come the acute diseases of the lungs, general tuberculosis, and tuberculous meningitis.

From the fifth to the fifteenth year the mortality in childhood is remarkably small, diphtheria and scarlet fever being still in the front rank in point of frequency. Next come the acute diseases of the lungs, simple as well as tuberculous meningitis, diseases of the bones, appendicitis, rheumatism, and cardiac disease.

Sudden Death.—This is not a very uncommon occurrence in infants who are apparently healthy. They are sometimes found dead in bed under circumstances in which grave suspicions may unjustly rest upon the attendants. The causes are often very puzzling. While sudden death sometimes occurs in children who are apparently in perfect health, it is very much more frequent in those who are delicate or suffering from malnutrition. Among this latter class, such as are seen especially in institutions, sudden death is by no means rare.

The most frequent causes of sudden death in infants are the following:

1. *Malformations.*—While in most cases, to be sure, malformations of a serious nature give rise to symptoms, they may be absent, or may be so slight as to be overlooked. Infants may succumb during the first few days of life from malformations of the heart, lungs, kidneys, stomach or intestines, and sometimes from diaphragmatic and umbilical hernia.

2. *Internal hæmorrhage.*—This is chiefly limited to the first two weeks of life. In the cases that have come to my notice the cause has been rupture of some subperitoneal hæmorrhage into the general abdominal cavity. The primary hæmorrhage is most frequently into the suprarenal capsule. It may be beneath the capsule of the liver. Such cases are reported in the chapter upon Visceral Hæmorrhages in the Newly Born. Under these circumstances no symptoms may exist until the occurrence of collapse, with death in a few hours.

3. *Asphyxia from overlying.*—This is not very common, excepting among the lower classes, and is most frequently due to intoxication on the part of the mother. Such children after death present the usual lesions

of death from asphyxia, but without any evidence of violence. This form of asphyxia is most frequently seen in infants a few weeks old. A recent writer in the British Medical Journal states that one thousand infants die every year from this cause in the city of London alone.

4. *Asphyxia from aspiration of food into the larynx and trachea.*—This may be due to vomiting or to the regurgitation of food during sleep; in a very weak infant it may occur while awake. This is usually seen in infants who are less than a year old, and most of the reported cases have been under six months. Such children are usually delicate. There seems to be vomiting with an attempt at crying, during which the food is drawn into the air passages. In some cases, as that reported by Demme, a single large clot of milk has been found in the larynx. In others, food is found in the larynx, trachea, and large bronchi. Cases have also been reported by Partridge and Parrot, and I have myself met with at least three. The infants have generally been found dead in bed within a few hours after feeding. This accident is more likely to happen when an infant lies upon its back.

5. *Asphyxia associated with enlargement of the thymus gland.*—I have notes of three such cases. Two of them occurred in the New York Infant Asylum and one at the Nursery and Child's Hospital. The children were aged respectively three, four, and ten months. The symptoms were asphyxia, followed by convulsions and death in a few hours. The thymus was in all the cases very greatly enlarged, the weight being over one ounce. Only one of these children was markedly rachitic. I have found in literature records of fifteen other cases of a similar nature in children varying from three to sixteen months. The symptoms in all have been similar to those in my own cases. The asphyxia is apparently due to pressure upon the pneumogastric. Rickets was present in about one half of the recorded cases.

6. *Atelectasis.*—In very young infants there may be no symptoms excepting malnutrition until sudden death occurs, sometimes with convulsions and sometimes without any such symptoms. I have in several instances known death to follow compression upon the lungs by the overdistended stomach, the symptoms coming on very soon after feeding or associated with an attack of indigestion. (See Atelectasis.)

7. *Marasmus.*—In this class of cases sudden death is of very common occurrence. These children are often as well two or three hours before death as for several weeks. Death frequently occurs at night, the children being found dead in bed in the morning. In some of the cases the exciting cause seems to be the lowering of the temperature, while in many no exciting cause can be found; the vital spark simply goes out after burning for some time with a feeble intensity. In some of these cases the autopsy reveals atelectasis, but in many cases nothing abnormal is found, death apparently resulting from heart failure.

8. *Convulsions in children previously showing no signs of disease.*—Most of these cases are seen in children who were previously rachitic. In them the autopsy shows no lesion except those commonly associated with death from convulsions. It is extremely rare for a cerebral lesion such as hæmorrhage to produce death in this way. In some of these rachitic cases death is due to spasm of the glottis.

9. *Asphyxia in older infants and young children.*—This may result from the pressure of a retropharyngeal abscess upon the larynx or trachea, or from the rupture of such an abscess during sleep and the entrance of pus into the air passages. While in most such cases other symptoms have been present, they may be latent. A rare cause of sudden asphyxia in children from eighteen months to five years is pressure upon the pneumogastric by tubercular bronchial glands, or by abscesses in the posterior mediastinum connected with caries of the spine. I have seen examples of both the latter. Gibney has reported a case of sudden death from dislocation of the upper cervical vertebræ consequent upon caries.

Sudden asphyxia may follow the ulceration of tubercular lymph nodes and the escape of cheesy masses into the trachea or primary bronchi. This usually occurs in children from two to five years old, and many cases have been reported.

10. *Death after a few hours' illness, in which the chief symptom is high temperature.*—This is quite a common occurrence. Children who are apparently well may be taken with great prostration and a high temperature, which may rise rapidly to 106° or even 107° F., with death in from six to twelve hours, sometimes preceded by convulsions. In my hospital experience I have met with many such cases. In infants, the most frequent explanation of these symptoms, as shown by autopsy, is acute congestive pneumonia; in older children it may be due to malignant scarlet fever or epidemic meningitis, although I have never seen an instance of either of these diseases in which death occurred in the first twenty-four hours.

It does not fall within the scope of this chapter to consider cases of sudden death from heart failure after diphtheria, with pleurisy with effusion, or with myocarditis. These will be discussed elsewhere.

PROPHYLAXIS.

There is no more promising field in medicine than the prevention of disease in childhood. The majority of the ailments from which children die, it is within the power of man in great measure to prevent. Prophylaxis should aim at the solution of two distinct problems: (1) The removal of the causes which interfere with the proper growth and development of children; (2) the prevention of infection. The former can come only through the education first of the profession and then the general public, in the fundamental principles of infant feeding and hygiene. This is a department which has received altogether too small a place in medical education. The latter must come through the profession, and through legislation, the purpose of which shall be more rigid quarantine, more thorough disinfection, and improved sanitation in all its departments.

THERAPEUTICS.

Treatment in the diseases of children, and particularly those of infants, is a difficult subject. Therapeutics in infancy consists in something more than a graduated dosage of drugs. Many therapeutic means which are valuable in adults are useless in children, and many others which are of little value in adults are extremely useful in children. There is no doubt of the truth of the statement that children in the past have suffered much from overzealous treatment, particularly from drug-giving. It should be a fundamental principle never to give a dose of medicine without a clear and definite indication. If this rule is followed, it is surprising to find how often medication can be dispensed with, and also, in many cases, how much better children do without drugs than with them. A second rule is equally important: never to give a nauseous dose when one that is palatable will answer the purpose equally well. This is no small matter, and one that is well worth the physician's careful attention, if he would succeed in the management of sick children. The simpler prescriptions are made, the better. As a rule, infants revolt against most of the highly seasoned sirups and elixirs which are used to disguise the taste of unpleasant doses. Bitter medicines when mixed with water, are frequently administered without the slightest difficulty.

It is a common mistake to underestimate the importance of the hygienic surroundings of the patient, the value of good nursing, careful feeding, and judicious stimulation, just as it is to overestimate the beneficial effects of drugs. In the great majority of acute ailments not serious in character for which a physician is called, the patient recovers quite as promptly without drugs as with them. This does not mean that such children require no treatment, but that the least important part of the treatment is drug-giving, while the most important part is attention to the hygienic matters just referred to. In cases of severe illness, in infants especially, we must avoid all unnecessary medication, in order that the stomach may not be disturbed and vomiting excited. Hence the importance of relying as far as possible upon local measures of treatment. The tendency to recovery from all acute processes, while seen in adults, is even more striking in children, where, if we can but remove that which hampers the bodily functions, Nature will conduct the case to a satisfactory termination. Thus, after an attack of ordinary bronchitis of no great severity, it is often seen that the disturbance of the stomach and intestines, which can be directly traced to the drugs employed, continues long after the original disease has subsided, and is very much more difficult to relieve. In diseases of the stomach and intestines especially there is a great amount of overmedication, very much to the detriment of the patient. In all chronic disturbances of nutrition—chronic indigestion, malnutrition, and anæmia—nothing is of so much value as change of air and surroundings. This is most striking in the case of city children. With them it is a frequent experience that tonics of every description are of little or no avail, and yet immediate and most marked improvement begins when the children are sent to the country.

The tablet triturates have furnished us with a convenient method of administering many drugs to children. Those which are especially useful are: calomel, from one tenth to one half grain; gray powder in the same doses; antimony and ipecac, one one-hundredth of a grain each; phenacetine, one to two grains; arsenious acid, one one-hundredth of a grain; paregoric, ♏v; Dover's powder, one tenth of a grain; atropine, one four-hundredth to one two-hundredth of a grain. This list might be very greatly extended.

As to the method of administration, it is to be remembered that several small doses are more easily given and less likely to disturb the stomach than a few larger ones. This method of administering very many drugs to children will be found extremely satisfactory — e. g., sodium bromide, one half grain every fifteen minutes, is often better than five grains every two hours; phenacetine, one half grain every half hour, is better than two grains every two hours; calomel, one tenth of a grain every hour, is better for constipation than a single dose of two grains.

Antipyretics.—The indications for the employment of antipyretics in children are somewhat different from those in adults. It is to be borne in mind that, where the cause is similar, all temperatures in children are higher than in adults. Thus a simple pharyngitis, which in an adult causes a rise of temperature only to 100° or 101° F., is in a child not infrequently accompanied by a temperature of 104°, or even 105° F. The height of the temperature, as measured by the thermometer, is not to be taken as the only guide for the employment of antipyretics. In many cases the temperature is 104°, or even 105° F., and yet the child exhibits no signs of unusual discomfort. Such a temperature manifestly does not call for interference. Again, a temperature of 103° F. may be accompanied by very marked restlessness and other signs of distress which may be relieved by employing some antipyretic measure. The number of cases seen in practice, of high temperature apparently from trivial causes, is very great. One must not be unduly alarmed even by a very high temperature if it is of short duration. It is the continuously high temperature which indicates serious illness. Whenever the temperature is found to be much above the normal it should be carefully watched, but not interfered with until a diagnosis has been made, unless the symptoms urgently demand it; otherwise the physician may lose one of the most valuable aids to diagnosis, since it is not the height of the temperature but its course which is significant. The routine practice of ordering full doses of antipyretic drugs whenever on the first visit an elevation of three or four degrees is discovered can not be too strongly deprecated. In many cases it is very important to know whether the temperature uninfluenced by drugs is remittent, intermittent, or steadily high, and hence the advantage of waiting until a diagnosis has been made before disturbing the temperature curve, always provided, of course, that the child is in no danger from the high temperature—a condition which is certainly not common. Since the cause of a great many obscure temperatures is found in the stomach and intestines, it very often happens that a purgative, stomach-washing, or intestinal irrigation may be the most efficient antipyretic. In cases of moderate elevation of temperature we need go no further than cold sponging.

The most reliable antipyretic measure for infants is the use of cold. This may be employed—

(1) *As an ice cap to the head.*—In many cases of quite high temperature and restlessness in infants this alone will reduce the temperature one or two degrees and allay the nervous symptoms. It may be used continuously or intermittently, according to circumstances.

(2) *Cold sponging.*—For this purpose water about 80° to 85° F., equal parts of alcohol and water, or equal parts of vinegar and water may be employed. In the case of infants, all the clothing except the diaper should be removed and the child laid upon a blanket. The body should be sponged for from ten to twenty minutes, preferably under a sheet which is thrown over the body. Cold sponging must be very frequently employed in order to be efficient in reducing high temperature. Its great value in allaying nervous symptoms, even when the temperature is not very high, is not sufficiently appreciated. Its effect is often more satisfactory than an anodyne.

(3) *Cold pack.*—This is one of the simplest and most efficient means of reducing temperature which can be employed. The child should be stripped and laid upon a blanket. The entire trunk should then be enveloped in a small sheet wrung from water at a temperature of 100° F. Upon the outside of this, ice may now be rubbed over the entire trunk, first in front and then behind. By this method there is no shock and no fright, and any ordinary temperature can usually be readily reduced. The rubbing with ice should be repeated in from five to thirty minutes, according to circumstances, after which the child may be rolled in the blanket upon which he is lying without the removal of the wet pack. The head should be sponged with cold water while this is being carried

on, and artificial heat, if necessary, should be applied to the feet. The pack is continued from one to twenty-four hours, according to circumstances.

(4) *The cold bath.*—This is more easily employed in the case of infants than larger children. The child is put into a bath at a temperature of 100° F., the bath being gradually lowered by the addition of ice to 85° or 80° F. The body should be well rubbed while the child is in the bath and water should also be applied to the head. On removal from the bath, the body should be quickly dried and rolled in a warm blanket. The bath is usually continued from five to twenty minutes.

(5) *Irrigation of the colon* is an efficient means of lowering the temperature. The water should be from 40° to 50° F.; it should be injected through a catheter, and not more than a pint should be introduced at one time. It is not to be advised except in cases of colitis, where the double purpose of lowering the temperature and cleansing the intestine may be accomplished at the same time.

Antipyretic Drugs.—Except in cases of malaria, quinine should not be employed for the reduction of temperature in children. The dose required is so large, the difficulty of administration is so great, and the tendency to upset the stomach is so uniform, that its use should be discouraged altogether; besides, its effect is extremely uncertain.

Of the three antipyretics more recently introduced—phenacetine, antipyrine, and antifebrine—their value in children is in the order named. Phenacetine, has the advantage of being tasteless, but the slight disadvantage of being insoluble. Antipyrine is so bitter as to make its administration often difficult. The prostration attending the use of antifebrine is rather greater than that of either of the others. None of these drugs is, however, to be employed in large doses with the sole purpose of reducing the temperature. Their great value in pædiatrics consists rather in allaying the nervous symptoms which accompany fever, and this purpose can be accomplished by the use of comparatively small doses. To an infant of one year, phenacetine or antipyrine can be given in one-grain doses every hour or two hours until the desired effect is produced. For a child of five years a dose of two grains may be given in the same manner. When used as indicated, these drugs are of very great value in making the patient more comfortable, in promoting sleep, and in allaying headache and general pains. In cases of hyperpyrexia they are, however, much less certain and less safe than the use of cold. In many cases of mild pyrexia the symptoms are relieved by the administration, either separately or in combination, of citrate of potassium, spiritus ætheris nitrosi, and liquor ammonii acetatis, in small frequent doses.

Stimulants.—In spite of the many statements to the contrary, alcoholic stimulants are well tolerated even by very young infants. Proportionately larger doses of alcohol than of most drugs may be administered to infants; still, stimulants, and alcohol in particular, are no doubt very greatly abused in the hands of many practitioners.

The indications for the employment of stimulants are much the same in young children as in adults. They are to be used whenever the pulse is weak, soft, and compressible, and whenever the general powers of the patient are very greatly depressed. In most of the acute fevers they are not to be given early in the disease, and in many cases they are not required at all; but whenever the patient's general strength is greatly reduced, and what is known as the typhoid condition develops, they are to be used freely, whatever the disease may be. They must often be used very sparingly while the temperature is high, but given freely as soon as it falls. In many acute febrile diseases stimulants are not called for at any period. This is especially true of most cases of lobar pneumonia. The time, however, when they are most likely to be needed is at or just after the crisis of the disease, when for twenty-four hours they should be very freely given. In broncho-pneumonia they are more uniformly required, and their use should be begun earlier. This is particularly true of the broncho-pneumonia which develops secondarily to the infectious diseases. In all toxic diseases, such as diphtheria, alcohol should be begun as soon as depressing symptoms show themselves, and continued in doses regulated by the degree of prostration. In the acute gastro-enteric diseases the depletion is often so great and there is so little absorption of food that the patients must in certain cases be sustained by alcohol for several days.

Alcoholic stimulants are contra-indicated in all acute febrile processes where there is high temperature, dry skin, flushed face, and a full, strong pulse. In such conditions they are often injurious.

The method of administering stimulants is of no little importance. Brandy and whisky are in most cases to be preferred to the wines, but not always. Champagne may be substituted when spirits are not well borne by the stomach. For infants under one year old, brandy should be diluted with at least eight parts of water. It is commonly given in too concentrated a form. Altogether the best method of administration is to determine the amount to be given in every twelve hours, have it diluted sufficiently, and then administer it in small doses at short intervals. In this way vomiting is rarely produced. The addition of brandy to the water required by the thirst makes it less likely to disturb the stomach.

The quantity of alcohol will depend very much upon circumstances. An infant one year old, for whom alcoholic stimulants are needed at all, should be given, to begin with, half an ounce of whisky or brandy during twenty-four hours, the quantity being increased for a short period to an ounce and a half, or in bad cases even to two ounces; but it is very rarely, if ever, advisable to go beyond this limit.

In children four years old double the amount may be employed in the corresponding conditions. Larger quantities than those mentioned are of doubtful advantage. Alcohol when used injudiciously is capable of doing much harm.

Tonics.—Cod-liver oil stands at the head of the list of tonics for young children. It is particularly in the convalescence after acute diseases of the respiratory tract that we see its most striking benefit. It is also of very great use in anæmia, and in a large number of children who are extremely delicate. In these patients it may be advantageously administered throughout the greater part of nearly every winter season. In convalescence after attacks of gastro-enteric disease it is not nearly so useful, and often must be withheld for a long time. It is a mistake to give cod-liver oil at any time when the tongue is coated, the digestion poor, and the stomach easily disturbed. In the case of infants, as a rule, the pure oil is to be preferred to the emulsions, but this is not always the case. The administration of small doses—i. e., ten or twenty drops of the oil three times a day continued for a long period—is much better than the use of larger doses for a shorter time.

A perfect preparation of iron for use in infancy has not yet been discovered. During the first few years all astringent preparations should be avoided. For use at this age the best forms are probably the bitter wine, Robin's peptonate, Gude's peptomanganate, Drees's albuminate, and the malate of iron. The peptonate and peptomanganate have the advantage of mixing easily with milk. For older children nothing is more satisfactory than Blaud's pills.

Arsenic is second only to iron in the treatment of the anæmia of children, and in very many cases it is to be preferred to iron. The tablet triturates of arsenious acid, one one-hundredth of a grain, may be given immediately after meals three times a day, or one or two drops of Fowler's solution largely diluted with water.

Alcohol is of very great value as a tonic in combination with some of the bitters, either small doses of quinine, nux vomica, or the bitter wine of iron. Usually wines, especially sherry, are to be preferred to spirits, although some children take spirits better. When combined with a bitter there is little danger of the formation of the alcoholic habit, even though its use may be long continued.

Of the bitter tonics, quinine and nux vomica are easily superior to all others.

Opiates.—Strong objections have been urged by many against the employment of opium in the diseases of infancy. While opiates have no doubt been abused, the fact remains that opium is almost as valuable a remedy in the treatment of disease during the first five years as at any other period of life. Infants are, however, peculiarly susceptible to the drug, and relatively much smaller doses are required than of most medicines. If the physician will accustom himself to the use of very small doses, he will be surprised to see how satisfactory are the effects produced.

The most useful preparations for young children are paregoric, Dover's powder, the deodorized tincture, morphine, and codeine. The following table gives what may be considered safe initial doses at the different ages:

	1 month.	3 months.	1 year.	5 years.
Paregoric	♏ i	♏ ii	♏ v to x	♏ xxx to xl
Deodorized tincture	♏ $\frac{1}{20}$	♏ $\frac{1}{10}$	♏ $\frac{1}{4}$ to $\frac{1}{2}$	♏ ii to iii
Dover's powder	Gr. $\frac{1}{20}$	Gr. $\frac{1}{10}$	Gr. $\frac{1}{4}$ to $\frac{1}{2}$	Gr. ii to iii
Morphine	Gr. $\frac{1}{1000}$	Gr. $\frac{1}{600}$	Gr. $\frac{1}{200}$	Gr. $\frac{1}{30}$ to $\frac{1}{20}$
Codeine	Gr. $\frac{1}{300}$	Gr. $\frac{1}{200}$	Gr. $\frac{1}{60}$	Gr. $\frac{1}{10}$ to $\frac{1}{8}$

Ordinarily doses like the above should not be repeated oftener than every two hours. In exceptional circumstances, as when very great pain is present, the dose may be given more frequently. In the hypodermic use of morphine it should be remembered that its effects are always more uniform and striking than when the drug is administered by the mouth, and the dose should therefore be smaller. In every instance where a full dose of opium has been given the physician should wait until the effects have subsided before the dose is repeated.

Anodynes.—Chloral is usually well borne even by quite young infants. In them it should never be administered by the mouth, but, on account of its irritant properties, always by the rectum. After rectal administration its effects are usually manifest in half an hour, and sometimes sooner. The dose for an infant of one month is one grain; three months, two grains; one year, three to five grains. It may be repeated every two to four hours, according to indications. Other drugs may replace this in most diseases, but in the case of infantile convulsions nothing is so reliable as chloral.

Belladonna is well borne by children, and in larger doses than most drugs. A tolerance is quite readily established. The eruption is more readily produced than the other physiological effects, and even quite small doses may be sufficient to bring out a very abundant blush. The parents should be advised of this fact, lest undue alarm be felt.

The drugs classed as antipyretics—phenacetine, antipyrine, and antifebrine—are exceedingly valuable in the treatment of many diseases of infancy where irritative nervous symptoms are prominent. In many cases they may advantageously take the place of opium, except where pain is the principal symptom, as in otitis or pleurisy. In all conditions where spasm is a prominent symptom, whether of the larynx or bronchi, or local or general convulsions, antipyrine is especially valuable.

Drugs well borne by Children.—In this list might be mentioned belladonna, the bromides, the iodides, chloral, quinine, calomel—in fact, all mercurials—and alcohol.

The drugs not well borne include particularly cocaine and all preparations of opium. In the case of many others, while the constitutional effects are well tolerated, they must be given carefully to young infants, since they are irritants to the stomach. In this class may be mentioned the salicylates, salol, the astringent preparations of iron, and the acids.

Counter-irritants.—These are of great value in a large variety of diseases. *Blisters* should never be employed in the case of infants, and very rarely, and never needlessly, in the case of older children. In the latter they may be required in inflammations of the ear, of the joints, or of the spine; they should never be applied to the chest.

The *mustard paste* is probably the most satisfactory means of producing quick counter-irritation over a large surface. To make a mustard paste: Take one part powdered mustard and six parts of wheat flour, mix with lukewarm water, and spread between two layers of muslin. This should be removed as soon as a thorough redness of the skin has been produced—in most cases from five to eight minutes, according to the strength of the mustard employed. This may be repeated as often as every three hours, and continued for a week if necessary, without producing excoriations of the skin. For older children the paste may be made one part mustard to four parts flour. In pulmonary diseases it should be large enough to surround the chest. When it is used to produce general reaction in heart failure it should cover the entire trunk.

The mustard pack.—The child is stripped and laid upon a blanket, and the trunk is surrounded by a large towel or sheet saturated with mustard water. This is made as follows: One tablespoonful of mustard to one quart of tepid water. In this a towel is dipped, and while dripping wound around the entire body. The patient should then be rolled in the blanket. This pack may be continued for ten or fifteen minutes, at the end of which time there will usually be a very decided redness of the whole body. It may be repeated according to indications. Where it is desired to produce a general counter-irritation, the mustard pack is not quite as efficient as the mustard bath, but it has the advantage in causing much less disturbance to the patient. The mustard pack is useful in the condition of collapse or of great prostration from any cause whatever, in convulsions, and in cerebral or pulmonary congestion.

The *turpentine stupe* is made by wringing a piece of flannel out of water as hot as can be borne by the hand. Upon this is sprinkled ten or fifteen drops of the spirits of turpentine. The stupe is then applied to the body and covered with oiled silk or dry flannel. It is useful chiefly in abdominal pains or inflammations, but in infancy must be carefully watched or vesication will be produced. For continuous use it is not so valuable as the mustard paste.

Stimulating liniments containing turpentine and other irritants are useful in inflammation of the chest, although less reliable than the mustard paste. One of the mildest and most useful preparations is camphorated oil. Another is olive oil four parts and turpentine one part. These may either be rubbed upon the surface, or a piece of flannel may be saturated with them and then applied to the skin. The old-fashioned spice bag is useful in many cases where a very mild counter-irritant is desired over the abdomen.

Dry cups may be used even in young infants, to relieve acute pulmonary congestion. They are sometimes of very great value, and may succeed in cases in which there is no reaction from the mustard. From four to six cups may be applied, and the effect may be continued by the application of the mustard paste. Wet cups should never be used in young children.

Poultices are useful in local inflammations about the glands of the neck, the joints, and in cellulitis in various parts of the body. The prolonged use of poultices can not be too strongly condemned in cases of otitis. In diseases of the chest, poultices may do harm because their weight embarrasses respiration, and sometimes because of the exposure when they are changed. They are most useful in pulmonary diseases in which there is great pain, as in pleurisy or in pleuro-pneumonia. In bronchitis and in broncho-pneumonia they are objectionable, certainly for prolonged use, on account of their weight. Better effects can generally be produced by hot fomentations and counter-irritation. Ground flaxseed is the best material for poultices. This should be mixed with boiling water until the proper consistency is reached, when the poultice should be put into a bag of muslin. The poultice should be covered with oiled silk or cotton batting, so that it will retain its heat as long as possible. To be of value, poultices must be applied hot and changed frequently.

Hot fomentations are more cleanly than poultices and much more easily changed. One of the best means of applying them is by a piece of spongio-piline wrung from water as hot as the hand can bear. Where this can not be obtained, a large piece of flannel may be used in the same way, covered with cotton batting, and then with oiled silk. This method of using hot fomentations is exceedingly satisfactory for applications to the extremities.

Cold.—Cold is useful in all forms of inflammation of the eyes and brain. In inflammation of the cervical lymph glands and of the joints it is of undoubted value, but its advantage over heat is questionable. The efficiency of both cold and heat in these cases depends largely upon the method of application. Sometimes in pleurisy much greater relief is obtained from the use of an ice bag to the chest than from hot applications, but this is not the general experience. The treatment of pneumonia by the application of the ice bag to the chest has some excellent advocates, although my own experience has not led me to look upon it with much favor. It is admissible only in lobar pneumonia. The use of cold in inflammations of the larynx, trachea, or bronchi is, in my opinion, positively contra-indicated, certainly so in infants and young children.

Cold is best applied to the head by an ice cap made like a helmet; an ordinary rubber or flannel bag filled with ice may answer the purpose. The rubber coil filled with ice water is also an excellent method. For inflamed glands or joints the ice bag should be used; for the eyes cold compresses changed every minute.

The Hot Pack.—All clothing is to be removed and the child's body covered with towels wrung from water at a temperature of from 100° to 110° F., after which the body should be rolled in a thick blanket. These hot applications may be changed every twenty or thirty minutes until free perspiration is produced, which may be continued as long as necessary. This is mainly useful in uræmia.

The Hot Bath, like the mustard pack or the mustard bath, may be used to promote reaction in cases of shock or collapse. The patient should be put into the bath at a temperature of 100° F., the water being gradually raised to 105°, or even to 110°, but rarely above this point. The body should be well rubbed while the patient is in the bath. A thermometer should be kept in the water to see that the temperature does not go too high. During the bath, in most cases, cold should be applied to the head.

The Hot-Air or Vapour Bath.—All the clothing should be removed and the patient laid upon the bed with the bedclothing raised above the body ten or twelve inches, and sustained by means of a wicker support. The bedclothing should be pinned tightly about the neck, so that only the head is outside. Beneath the bed clothing hot vapour is introduced from a croup kettle or a vapourizer. This will usually induce free perspiration in fifteen or twenty minutes. It may be continued from twenty to thirty minutes at a time. Instead of vapour, hot air may be introduced in the same way. The air space about the body is indispensable. The vapour bath is applicable chiefly to cases of uræmia.

The Mustard Bath.—Four or five tablespoonfuls of powdered mustard should be mixed for a few minutes with one gallon of tepid water. To this should be added four or five gallons of plain water at a temperature of 100° F. The temperature of the bath may be raised by the addition of hot water to 105° or 110° F. if desired. Nothing is more efficient than the hot mustard bath for a general derivative effect in bringing the blood to the surface in cases of shock, collapse, heart failure from any cause, or in sudden congestion of the lungs or brain. The bath should not usually be continued for more than ten minutes. If necessary, it may be repeated in an hour.

The Bran Bath.—Put one quart of ordinary wheat bran in a bag made of coarse muslin or cheese cloth and place this in four or five gallons of water. The bran bag should be frequently squeezed and moved about until the bath water resembles a thin porridge. It may be of any temperature desired, but usually about 90° to 95° F. is best. A bran bath is of great value in cases of eczema, excoriations about the buttocks, or in other cases where the skin is very delicate, and plain water seems to irritate it.

The Tepid Bath may be given at a temperature of 95° to 100° F. It is very useful in many conditions of excitement or extreme nervous irritability. To induce sleep it is often more efficient than drugs.

The Cold Sponge or Shower Bath should be given in the morning before breakfast, and in a warm room. The child should stand in a foot tub containing warm water enough to cover the feet, then a large sponge holding about a pint of water at a temperature of from 40° to 60° F. should be squeezed three or four times over the chest, shoulders, and spine of the child, the skin being rubbed meanwhile. The bath should not last more than half a minute. It should be followed by a brisk rubbing until a thorough reaction is established. This is very useful at all ages, but a particularly valuable tonic in delicate children. It may be used in those only eighteen months old. Not the least of the beneficial results is the full expansion of the lungs from the strong cry which the bath usually excites. In younger infants a cold plunge may be substituted. This should be merely a single dip of the entire body in water at a temperature of 50° to 60° F. In order that beneficial effects shall follow the cold plunge or cold sponging, a good reaction must be established. If children lack sufficient vitality to secure this, and if they remain pale, pinched, and blue for some time after the bath, it must be discontinued altogether, or water of a higher temperature used.

Nasal Spray.—This may be either of an aqueous or oily solution. For the oil spray an atomizer similar to that shown in the accompanying cut should be employed. It is valuable in cases of dry catarrh, where there is a formation of crusts in the nose. A variety of oils may be used in the spray, albolene being perhaps as satisfactory as any. Fig. 8 shows an efficient atomizer for albolene.

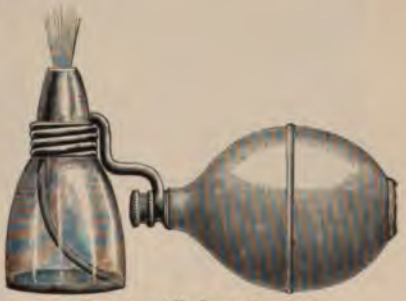
FIG. 8.—Albolene atomizer.

There are a good many forms of hand atomizers to be found in the market for the production of an aqueous spray. For a cleansing nasal spray, Dobell's[*] solution, Seiler's[†] solution, Listerine ten-per-cent solution, or a two-per-cent solution of boric acid may be used.

Nasal Syringing.—In cases of considerable nasal obstruction and in the more serious affections of the rhino-pharynx only the syringe can be considered an efficient means of cleansing the cavity. The nasal syringe should be small enough to be easily worked with one hand. It should have a soft-rubber tip to prevent injuring the nose, and the tip should be large enough to fill the nostril. The best syringe for nasal use is shown in Fig. 9. This is made either of glass or hard rubber and fulfils all the conditions mentioned.[‡] It is easy of action, can be readily cleansed, and holds about half an ounce. The same syringe should not be used for more than one patient, unless it has been very thoroughly disinfected. In hospitals, and even in private practice, nasal syringes are frequent carriers of infection. Two positions may be used in nasal syringing. In diphtheria, scarlet fever, or any constitutional disease attended by great depression, the child should not be removed from the bed. The syringing may be done by a single nurse who stands at the head of the bed, alternately syringing the right and left nostril, turning the head from side to side (Fig. 10). The other method is to hold the child erect on the lap with the head in-

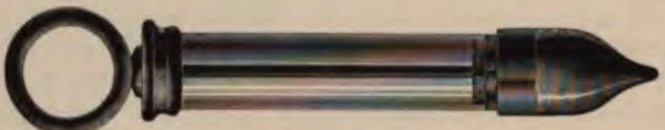

FIG. 9.—Nasal syringe.

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[*] Dobell's solution:

Sodium biborate	ʒ j
Sodium bicarbonate	ʒ j
Glycerin of carbolic acid	ʒ ij

Water to make half a pint.

[†] Seiler's solution:

Sodium bicarbonate	℥ j
Sodium biborate	℥ j
Sodium benzoate	gr. xx
Sodium salicylate	gr. xx
Eucalyptol	gr. x
Thymol	gr. x
Menthol	gr. v
Oil gaultheria	gtt. vj
Glycerine	℥ viij ss.
Alcohol	℥ ij

Water to make sixteen pints.

This is also sold in tablets, one of which is dissolved in four ounces of water to make the solution of the above strength.

[‡] This is made by the Goodyear Company.

clined a little forward, the syringing being done by a person who stands behind. In syringing, the water should come out of the opposite nostril or out of the mouth, to make it certain that the rhino-pharynx has been reached. When properly done, no prostration and very little irritation are caused.

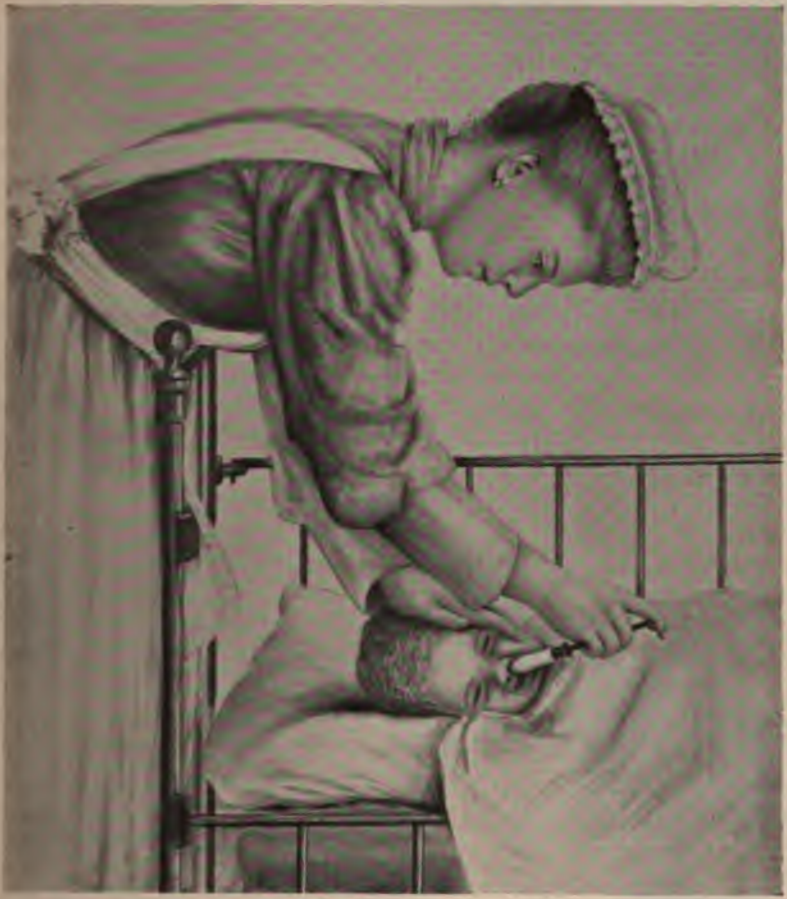

FIG. 10.—Method of syringing the nose.

Syringing the mouth and pharynx is useful in many pathological conditions of these parts, particularly in children too young to gargle. Either an ordinary hard-rubber piston syringe or a bulb (Davison) syringe may be used. If the pharynx is to be reached, the nozzle is used as a tongue depressor. This should be placed at the angle of the mouth between the back teeth. The child should be held in the sitting posture, with the head inclined forward. Only mild solutions should be employed.

Inhalations.—These are of very great utility in all affections of the respiratory tract. To be efficient, the patient should be put under a tent. A satisfactory tent may be made by erecting a T-shaped piece of wood at the head and foot of the crib and throwing over this a large sheet folded and pinned at the corners. Another method is, to stretch a cord around the top of each of the four posts of the crib, or simply from the centre of the head piece to the centre of the foot piece; the sheet should be used as in the first instance. A very good tent may be improvised by throwing a large sheet over an open umbrella. Instead of an ordinary cotton sheet one of rubber cloth may be used. For hospital use I have found it convenient to have a rubber cover made to fit closely over the top of the crib to be used for inhalations. The better the tent the more satisfactory are the results from inhalations.

Inhalations may be in the form of vapour or spray. The apparatus employed may be the croup kettle, the vapourizer, or the steam atomizer. As all of these are used with alcohol lamps, innumerable accidents from fire have occurred with them. Patients and nurses should always be cautioned regarding this. The ordinary croup kettle is a clumsy affair and especially likely to be the cause of accidents. In Fig. 11 is shown one of an improved pattern,* which possesses the advantages both of the ordinary croup kettle and of the vapourizer. The base has been weighted, to prevent the apparatus being easily upset. The pail is low, which fact also contributes to its stability. It is provided with a safety alcohol lamp, the flame of which can be regulated by a screw. The lamp holds enough alcohol to burn from five to six hours. This kettle may be used to produce simple vapour, or vapour from lime water, or a medicated vapour may be employed. If the latter is desired, the substance to be vapourized is placed on a sponge held in the expansion of the spout. The kettle should be filled with hot water before using. It should be placed upon the floor or a low box beside the crib, so that the end of the spout is just inside the tent at a level with the surface of the bed.

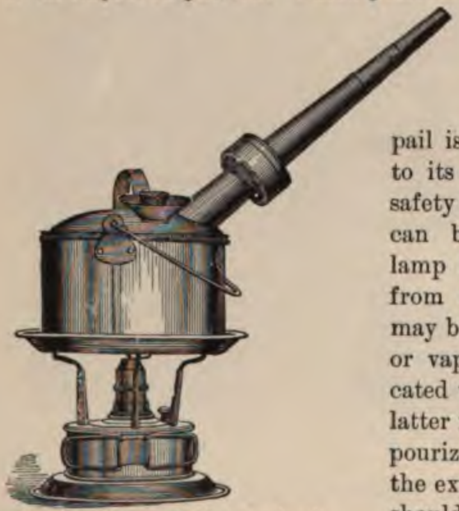

FIG. 11.—The author's croup kettle.

The vapourizer † (Fig. 12) is one of the most satisfactory means of obtaining medicated inhalations. The boiler is half filled with water, and the substance to be vapourized is placed upon a sponge which lies on a perforated diaphragm placed at the top of the boiler, so that all the steam generated in the boiler passes through it.

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* Made by Lewis & Conger, New York.

† Made by Whitall & Tatum, Philadelphia.

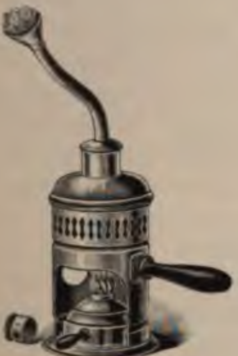

FIG. 12.—Vapourizer.

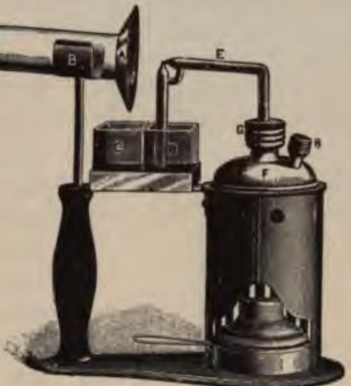

FIG. 13.—Steam atomizer.

The steam atomizer is shown in Fig. 13. For this no tent is required. It should be placed about one and a half or two feet from the patient's face, and the clothing protected by a rubber sheet. This is very efficient where steam or vapour of lime water are used, but is not to be advised for carbolic acid, creosote, etc.

Oiled-silk Jacket.—In all forms of acute pulmonary inflammation this form of local application has largely supplanted the time-honoured poultice, both in hospital and in private practice. It keeps the skin at a uniform temperature, maintains a moderate degree of counter-irritation, and gives the patient a great deal of comfort. The jacket consists of three layers—an outer one of oiled silk, an inner one of cheese cloth or gauze, and a middle one of cotton batting or wool. The middle layer should be half an inch in thickness. The purpose of the lining is to keep the cotton in position. Fig. 14 shows the pattern of the jacket. It is generally made in two pieces, each of which should be about twelve inches wide and twelve inches long for a child of one year. These are sewed together along one border and lapped at the other, where it is secured by safety pins A properly made jacket will last two weeks.

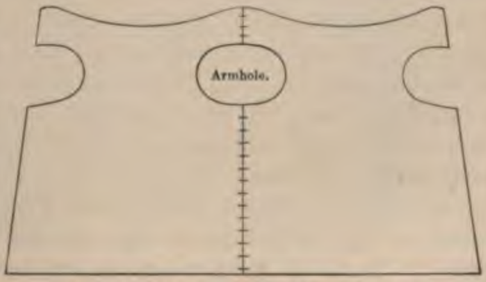

FIG. 14.—Pattern for oiled-silk jacket.

Stomach-Washing consists in the introduction of water into the stomach through a flexible catheter or stomach tube and then siphoning it out. It was introduced into general practice among infants by Epstein, of Prague. To Seibert (New York) is due the credit of bringing the subject prominently before the minds of the medical profession in America. It is one of the most valuable therapeutic measures we possess. Stomach-washing has been employed almost daily for the past seven years in the hospitals with which I am connected, during which period the stomach has been washed many thousand times. No accident whatever has occurred, and the operation may be considered entirely free from danger; in fact, it is difficult to pass the tube anywhere else than into the œsophagus. The amount of prostration may be compared to that of an ordinary attack of vomiting.

The apparatus for stomach-washing is very simple (Fig. 15). There is required a soft-rubber catheter, size 16, American scale (24 French)—one with a large eye is preferred; a glass funnel, holding four to six ounces; two feet of rubber tubing, and a few inches of glass tubing to join this to the catheter. The child should be held in a sitting posture (Fig. 16), the body well protected by a rubber sheet, with a large basin conveniently near. The catheter should be moistened. While the tongue is depressed with the forefinger of the left hand, the catheter is passed rapidly back into the pharynx and down the œsophagus. It is important that the first part of the introduction should be as rapid as possible, for if the child begins to gag from the pharyngeal irritation the introduction of the tube may be quite difficult. No resistance is ordinarily encountered after the tube reaches the œsophagus. About ten inches of the catheter should be passed beyond the lips. When it has reached the stomach the funnel should be raised as high as possible, to allow the escape of gases almost invariably present. It should then be lowered, in order to siphon out the fluid contents. If nothing escapes, the funnel is then to be raised and from two to six ounces of water poured into it from a pitcher; the funnel is then lowered and the water siphoned out. This procedure is repeated from four to ten times, or until the fluid comes back perfectly clear. About a quart of water is ordinarily used. Various solutions have been advised

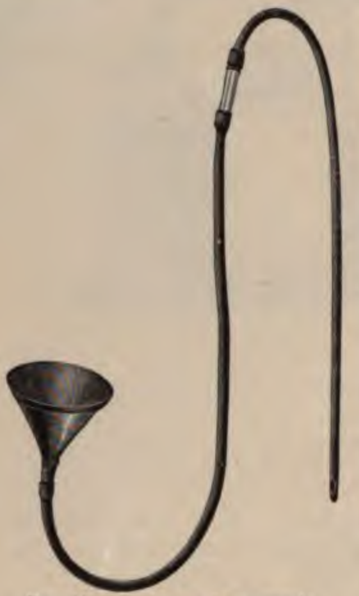
FIG. 15.—Apparatus for stomach-washing.

for stomach-washing, but nothing is better than boiled water, used at the temperature of from 100° to 110° F.—the higher temperature being employed when the gastric irritation is very great. Through the tube are easily discharged mucus and small curds; larger ones are gradually broken down by repeated washing. Vomiting may be induced by overdistending the stomach with water. If there is great thirst there is often an advantage in leaving one or two ounces of water in the stomach. To this water it is at times beneficial to add lime water.

Stomach-washing in its application is practically limited to children under two and a half years. It is easiest in those under eighteen months. Children of three years and over are usually so much alarmed and struggle so violently as to make it difficult and undesirable.

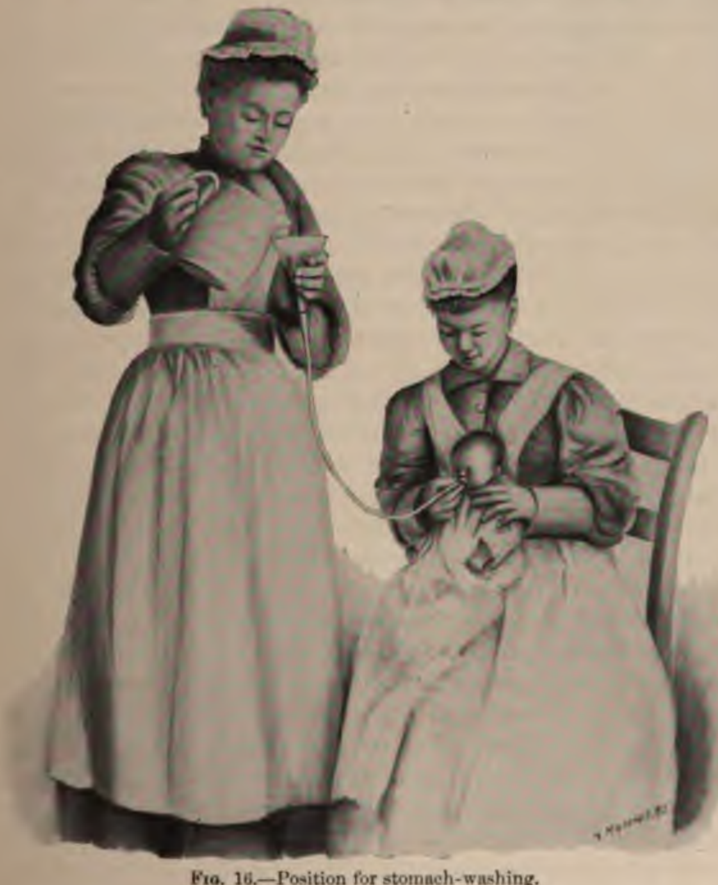

FIG. 16.—Position for stomach-washing.

The indications for stomach-washing are: 1. In acute indigestion, either with or without persistent vomiting. Here the purpose is simply to clear the stomach of its irritating contents, and a single washing may be sufficient. 2. In chronic indigestion attended with a great production of gastric mucus, and sometimes, though rarely, by dilatation of the stomach. In these cases daily washing is required for a considerable period. 3. In poisoning.

Gavage.—Gavage consists in the forcible introduction of food into the stomach through a tube. It has long been employed in France, and was popularized there by Tarnier in the treatment of premature infants. Until 1892 it was but very little used in this country—chiefly after operations upon the mouth and larynx. Recent experience, however, has shown it to have a much wider application.

The same apparatus is employed as in stomach-washing, and the method is similar, with the exception that for gavage the child should be placed flat upon the back, the head being steadied by an assistant. In older children a mouth-gag is often necessary. Sometimes, where there is great resistance to the introduction of the tube through the mouth, it may be passed through the nose. After the tube has entered the stomach the funnel should be raised to allow the gas to escape. The food is then poured into the funnel; as soon as it has disappeared the tube is tightly pinched and quickly withdrawn, to prevent food from trickling into the pharynx, since this is often a cause of vomiting. In young infants, after removing the tube, it is well to keep the jaws separated by the fingers for a few moments to prevent gagging. If the food is regurgitated this usually happens at once. It may then be introduced a second time. After feeding, the child should be kept absolutely quiet upon the back.

In cases where all the food is given by gavage the interval between feedings must be considerably longer than under other circumstances. The food given should be either wholly or partly predigested, since digestion in these cases is usually feeble. The stomach should be washed before the first feeding, and afterward at least once a day, in order to remove mucus and to be sure that it is empty before the meal is given.

Gavage is valuable, as already indicated in connection with the incubator, in the management of premature infants and after certain operations upon the mouth and neck. It is also useful, first, in the case of very young infants, who, suffering from severe malnutrition, can not be induced to take food enough to sustain life; secondly, in many acute diseases, particularly in septic cases where the child will not readily take the necessary food, as in diphtheria, scarlet fever, typhoid, pneumonia, etc.; thirdly, in many cases of cerebral disease where food is refused on account of delirium or coma; and, fourthly, in uncontrollable vomiting. This last use of gavage has been very fully worked out by Kerley, who found, after a large number of experiments, that food given by gavage was often retained, when very much smaller quantities administered by the spoon, bottle, or even from the breast, were immediately vomited. Kerley's experiments were conducted in the New York Infant Asylum during my service there, and his results have been verified by subsequent experience in that and in other institutions. The explanation seems to be that the passage of the tube causes less irritation of the pharynx than does the food after it has been swallowed, vomiting being due apparently to such pharyngeal irritation.*

Gavage is a very simple procedure and one which a nurse can easily be taught. It is free from danger, and in a great majority of cases food is not regurgitated. Much of the success in using it depends upon the rapidity with which it can be done. With a little experience only fifteen or twenty seconds are required. In acute septic cases not only may food be given, but also such medicines and stimulants as may be required, with little or no trouble. The advantage of gavage over the continued coaxing or holding the nose and forcing the patient to swallow will be at once apparent to one using it.

Irrigation of the Colon.—By irrigation of the colon is meant the flushing of the entire large intestine by fluids injected high up through a catheter or rectal tube. Under no circumstances is it possible to inject fluids beyond the ileo-cæcal valve, but we can be quite sure that if proper precautions be taken they will reach as high as this point.

The apparatus required for irrigating the colon is a fountain syringe, five or six feet of rubber tubing, and a flexible rectal tube or soft-rubber catheter—No. 18 or 20, American scale, being preferred. The child is placed upon the back, with the thighs flexed and the buttocks brought to the edge of the bed or table. It should lie upon a rubber sheet so arranged as to form a trough emptying into a large basin or tub. The clothing is rolled up to the hips. The bag containing the water is hung four or five feet above the bed. The catheter is oiled and inserted just within the anus before the water is turned on. As it flows the catheter is gradually pushed upward to a distance of twelve or fourteen inches. The water distending the intestine in advance of the catheter usually makes its introduction quite easy. If, however, the attempt be made to introduce the catheter before turning on the water, it almost invariably doubles upon itself. In Fig. 17 is shown the colon of an infant of six months in position. It is the peculiar curve and the great length of the sigmoid flexure that make the introduction of water difficult, unless the tube is passed quite to the descending colon. When this is done the remainder of the colon fills with ease; but if the tube is introduced only three or four inches the irrigation is not likely to extend beyond the sigmoid flexure.

Usually a pint, and often a quart, will be introduced before any water returns. This is an advantage, since one can then be reasonably sure that the upper part of the colon has been reached. The water is passed from time to time alongside the catheter, often with considerable force. At least a gallon of water should be used for a single irrigation. The washing should be continued until the water returns quite clean. Gentle kneading of the abdomen should be continued during the irrigation, particularly the early part of it, to facilitate the passage of the water into the upper part of the colon. At the end of the irrigation the rubber tube is detached and the water allowed to escape through the catheter, which remains *in situ*. Sometimes as much as a pint of water remains in the intestine. This is usually passed within half an hour. As the irrigation of the colon almost invariably excites active peristalsis of the lower ileum, this part of the intestine is emptied as well. It is to be remembered that the colon of an infant six months old will hold one pint without distention, and at the age of two years from two to three pints.

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* For fuller report of Dr. Kerley's cases see Archives of Pædiatrics, February, 1892; also article by the writer, New York Medical Record, April 28, 1894.

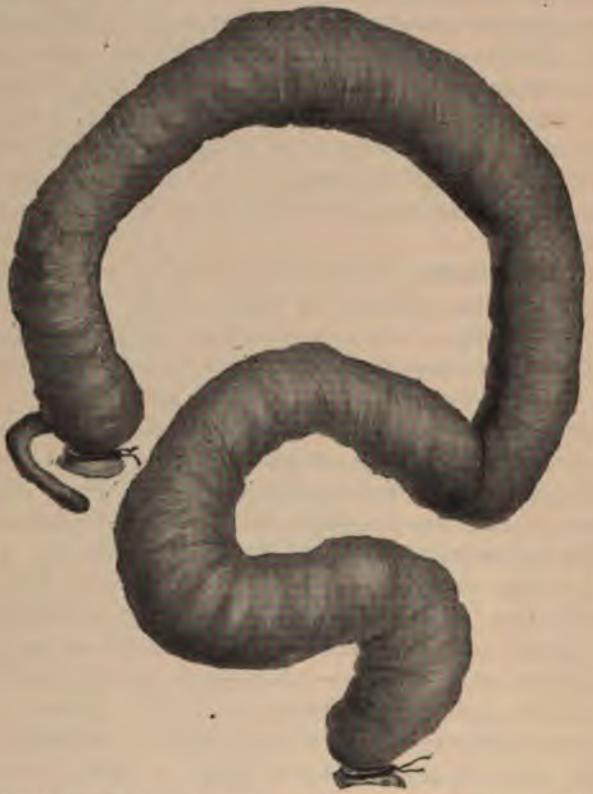

FIG. 17.—Colon of a child six months old, in position. (From a photograph.)

Irrigation of the colon is useful to clear this part of the intestine of mucus, fæcal matter, undigested food, and the products of decomposition.

It may also be employed as a means of local medication in ileo-colitis. Where the object is simply to cleanse the intestine, a saline solution—a teaspoonful of common salt to a pint of water—is preferred. In cases of inflammation of the colon various astringent injections may be used; but the employment of antiseptic injections is of doubtful advantage.

The temperature of the water used for irrigation may be varied according to the special indications. For ordinary purposes, where cleansing only is aimed at, the temperature of from 80° to 95° F. seems to be best. When the body temperature is high, or when there is much pain, tenesmus and straining, ice water has important advantages. The patient's temperature may often be reduced as effectively by an ice-water injection as by a bath. In cases of collapse or great prostration hot injections may be employed; these should not be higher than 110° F., but at this temperature they may be used with safety.

Irrigation under most circumstances is required only once in twenty-four hours. When it is employed it is important to use a large quantity of water. In cases of ileo-colitis with severe symptoms two irrigations a day may be advantageous. This means of treatment certainly forms a most valuable addition to our therapeutics in the management of intestinal diseases. With ordinary care irrigations are free from danger. They must be done thoroughly to be of value, and either by the physician himself or an experienced nurse. The chief points of importance are, that the catheter should be introduced high into the bowel, and that a large quantity of fluid should be employed.

Enemata.—Simple enemata are useful in infants and older children, to empty the bowels in cases of constipation. Where an immediate effect is desired the most efficient is one containing glycerine—e. g., for an infant, one teaspoonful to one ounce of water. Oil enemata are useful where the fæcal mass is hard and dry and expelled with difficulty. For this purpose from two drachms to half an ounce of sweet oil may be given. Enemata should always be given with care, and preferably a rubber tube should be attached to the nozzle of the syringe, since injury may be done by a hard-rubber or metal tip.

Nutrient enemata are of very little value in infancy. In older children they may be used as in adults. For this purpose either completely peptonized milk or some of the forms of beef peptones, like Mosquera's beef jelly, may be employed. In giving stimulants in enemata care should always be taken that they be well diluted—one part of brandy to at least eight parts of water.

The administration of drugs *per rectum* is useful in certain cases where, on account of the unpleasant taste or vomiting, the administration by mouth is difficult. In this connection we may mention particularly quinine and chloral. As a diluent milk is preferable to water. If quinine is used, the bisulphate is the best preparation, but this must be well diluted.

The use of stronger solutions than four grains to the ounce often results in the production of rectal catarrh. The temperature of all enemata which are to be retained should be about 100° F. It is necessary in infancy to press the buttocks together for at least an hour afterwards to prevent the expulsion of the injection.

Hypodermic Medication.—This is not often used in childhood, but it must not be forgotten that it is at times of the greatest service even in infancy. The use of morphine hypodermically in convulsions, of morphine and atropine in cholera infantum, of atropine in opium poisoning, of strychnine in heart failure, as in pneumonia and syncope, may be cited as examples. These are all conditions in which the hypodermic needle may save life.

Massage.—In older children massage is useful for the same conditions as those for which it is employed in adults; the most important are anæmia and general malnutrition—in conjunction with the "rest treatment"—in chorea, and in chronic constipation. For the last mentioned only abdominal massage is employed. The special method of doing this will be referred to in the chapter on Constipation. In children, even more than in adults, it is necessary that in the beginning only the mildest movements of massage should be employed, and these but for a short time.

In infancy massage has a limited application, and it is doubtful whether it really does more than can be accomplished by the general friction of the body. This rubbing, either with the bare hand, or with cocoa butter, or some other fat, is very useful in all forms of malnutrition, in rickets, and in wasting diseases where the circulation is feeble and the muscular tone low. Any form of fat may be employed for inunction. Cocoa butter is cleanly and has a pleasant odor, and is, I think, quite as valuable as the more commonly employed cod-liver oil, which is exceedingly disagreeable. The inunctions should be given daily after the morning bath, the child lying upon the nurse's lap before an open fire, covered only by a blanket. The rubbing should be continued for fifteen to twenty minutes each time.

PART II.

SECTION I.

DISEASES OF THE NEWLY BORN.

CHAPTER I.

ASPHYXIA.

THE lungs in the full-term fœtus are of a uniform dark red colour, and show very distinctly upon their surface the lobular divisions. They are firm and solid and readily sink in water. The connective tissue is very abundant, and forms distinct fibrous septa, which stretch through the lungs in every direction.

Inflation of the lungs begins with the first cry uttered by the infant as it is born into the world. The parts first expanded are the anterior borders of the lungs, then the upper lobes, and finally the lower lobes posteriorly. The superficial lobules are nearly always expanded before those in the interior of the lung. The inflation is sometimes irregular, because of the accumulation of mucus in some of the bronchial tubes. The right lung is frequently stated to be expanded earlier than the left. Although this is often the case, there is no uniformity in this respect. The important point to be remembered is, that the parts last inflated are the posterior portions of the lower lobes. The expansion of the lungs is a gradual process, and in healthy infants it is probably not complete much before the end of the second day. In delicate children it may be postponed for several days, or even weeks. The above statements are based upon post-mortem observations upon infants dying from various causes during the first weeks. It has often been a matter of great surprise to find at autopsy on an infant two or three days old, that less than one half of the lung tissue was expanded, although the child had breathed well and shown no signs of atelectasis. Under normal conditions at full term inflation of the lung takes place very readily, but not so readily in premature or delicate infants, on account of the feebleness of the respiratory muscles. The longer it is postponed after birth the more difficult does it become, on account of the changes which occur in the collapsed air vesicles. The condition of the child *in utero* may be described as one of fœtal apnœa, its oxygen being received and its carbon dioxide discharged through the placenta, which is essentially the organ of respiration at this period. This condition is interrupted by cutting off the supply of oxygen and the accumulation of carbon dioxide in the blood. Which of these is the important factor in inducing pulmonary respiration has been much debated; but the best experimental evidence seems to show that it is the want of oxygen which stimulates the respiratory centres.

Under the term "asphyxia" may be included all cases in which primary respiration is not spontaneously established with sufficient force to maintain life. Usually there is no attempt at pulmonary respiration until after the birth of the child, but it may occur *in utero* or at any stage of parturition. Asphyxia may be of intra-uterine or extra-uterine origin.

Etiology.—1. *Intra-uterine asphyxia.* The maternal causes include any disturbance of the placental circulation during labour—anything which prolongs the second stage of labour, convulsions, hæmorrhage, the use of ergot in the second stage, or, finally, the death of the mother. The causes relating to the child are pressure upon the cord, multiple winding of the cord about the neck, early separation of the placenta, and pressure upon the brain. If the respiratory stimulus comes before the birth of the child, the effort at respiration may cause the entrance into the mouth and air passages of amniotic fluid, mucus, blood, meconium, etc.

2. *Extra-uterine asphyxia.* This condition is a much less common one. It arises from causes quite apart from those above mentioned, and depends upon malformations or intra-uterine disease of the organs of respiration, circulation, or of the brain. It may be secondary to an injury of any of these organs received during parturition. It is also seen in premature infants, where it depends upon the feeble development of the nerve centres and respiratory muscles and upon the soft, yielding chest walls.

Lesions.—In infants dying of intra-uterine asphyxia there are seen the usual changes found in death from suffocation, together with the effects of attempts at breathing *in utero*. There is general congestion of all the viscera, particularly of the brain and its meninges, the liver, and the lungs. They may show small, punctate hæmorrhages, and occasionally large extravasations. Blood or bloody serum may be found in any of the serous cavities. The right heart is overdistended with dark, soft clots, and the blood generally is more fluid than normal. The lungs may contain no air, but more frequently there are small, scattered areas in which lobular inflation has taken place. If the child has lived several hours there are larger areas of expanded lung, especially in the upper lobes, and these may even be emphysematous, if artificial inflation has been employed. In the mouth, nose, larnyx, and even as far as the finest bronchi, there may be found aspirated materials—amniotic fluid, blood, mucus, or meconium. In extra-uterine asphyxia there are organic changes in the viscera—malformations of the lungs or the heart, intra-uterine pneumonia or pleuritic effusion, malformation of the diaphragm and sometimes of the brain.

Symptoms.—Under normal conditions the newly-born infant begins at once to scream and to use its limbs, the purplish colour of the skin giving place in a few moments to a rosy pink. In the first degree of asphyxia—*asphyxia livida*—the child is deeply cyanosed. Either no attempt whatever is made at respiration, or it is superficial and repeated only at long intervals. The pulse is slow, full, and strong. The vessels of the cord are distended. Muscular tone is preserved, and also cutaneous irritability, so that with the application of almost any kind of external stimulus, respiration is excited and the symptoms disappear.

In the second degree—*asphyxia pallida*—the picture is quite a different one. The face is pale and death-like, though the lips may still be blue. The heart's action is weak, and by palpation can rarely be felt at all. By auscultation the sounds are feeble, irregular, and usually slow. The cord is soft, pale, and flaccid, and its vessels nearly empty. The sphincters are relaxed, and meconium oozes from the anus. There is entire loss of tone in the voluntary muscles, so that the extremities and entire body seem perfectly limp. Cutaneous sensibility is abolished. The extremities are often cold. There may occur a few short, convulsive contractions of the respiratory muscles, but these are without effect and soon cease. Unless such cases receive the most prompt and efficient treatment, the heart's action becomes more and more feeble until it ceases and death occurs. Other cases are partly resuscitated and may survive for a few hours or days, when they gradually sink, respiration becoming more and more feeble in spite of all efforts to maintain it. Between these two extremes all degrees of severity are seen.

In extra-uterine asphyxia there may be some attempts at voluntary respiration continuing for several hours, sometimes for a day or two, but this may be inadequate to sustain life.

Diagnosis.—Almost the only condition with which asphyxia is likely to be confounded is cerebral compression from a meningeal hæmorrhage. The difficulties in the case are much increased by the fact that the two conditions are not infrequently associated. It may then be impossible to tell that in addition to asphyxia, intracranial hæmorrhage is present. If the hæmorrhage is extensive and the asphyxia only moderate, a diagnosis is possible in most of the cases. In hæmorrhage there is often a history of undue compression during delivery—sometimes the use of forceps. The fontanel is bulging; there is coma, and there may be paralysis. The respiratory murmur may be quite strong for several hours, but it gradually fails as the child becomes completely comatose. Anæmia resulting from a large hæmorrhage, like that due to rupture of the cord, may simulate the severe form of asphyxia.

Prognosis.—This depends upon the grade of asphyxia and the treatment employed. There is but little tendency to spontaneous recovery in any form. In the milder cases recovery is almost invariable with any intelligent treatment. In the severest cases the outcome is always doubtful, although by persistent effort many that are apparently hopeless may be saved. In a prognosis as to the ultimate result, the frequent complication of asphyxia with meningeal hæmorrhage should always be kept in mind. Apart from this complication it is doubtful whether asphyxia has anything to do with the production of idiocy.

Treatment.—In every case the first step is to clear the mouth and pharynx of mucus by means of the finger covered with absorbent cotton. In the milder forms respiration is usually excited either by spanking the child or the alternate use of hot and cold baths. If the hot bath is employed, the water should be from 110° to 120° F., or about as hot as the hand will bear. After a few moments the child may be dipped into cold water, or the body may be douched with it. In the livid cases relief is often afforded by allowing the cord to bleed for a few moments before ligation. The loss of half an ounce of blood is ordinarily sufficient. Simply swinging the child in the air is a powerful stimulus to respiration. The above means will suffice in the great majority of cases. In the more severe forms, however, these are inadequate. There is no response whatever to external stimulation, either by heat or mechanical irritation. In these cases two methods of resuscitation may be employed: artificial respiration and direct inflation of the lungs.

One of the most widely employed methods of inducing artificial respiration is that of Schultze. The infant is grasped by both axillæ in such a way that the thumbs of the physician rest upon the anterior surface of the chest, the index fingers in the axillæ, and the remaining fingers extending across the back. The child is thus suspended at arm's length between the knees of the physician, the feet downward and the face anterior. The body is now swung forward and upward, until the physician's arms are nearly horizontal. This produces the inspiratory effort. When this point is reached, an arrest in the swinging causes flexion of the trunk, the head now being directed downward, the lower extremities fall toward the physician until the whole weight of the body rests upon the thumbs. In this way expiration is produced. Lusk cautions against the employment of this method if the heart's action is very feeble, as it may cause the heart to stop altogether.

A method introduced by Dew has been extensively employed in New York. The infant is grasped in such a way that the neck rests between the thumb and forefinger of the left hand, the head being allowed to fall far backward, the upper portion of the back resting upon the palm of the hand; with the right hand the knees are grasped between the thumb and fingers, the thighs resting against the palm of the hand. Inspiration is produced by depressing the pelvis and lower extremities thus causing the abdominal organs to drag upon the diaphragm, and at the same time gently bending the dorsal region of the spine backward. In expiration the movement is reversed, the head being brought forward and flexed upon the thorax, while at the same time the thighs are flexed so as to bring them against the abdomen. The body is thus alternately folded upon itself and unfolded as the movements are carried on. If there is much mucus in the mouth, the movement of expiration should first be made with the body completely inverted. This method is simple, efficient, and much less fatiguing than that of Schultze when it is to be maintained for a long time. It is also of great advantage in that it can be carried on while the child is in the hot bath, one of the greatest objections to the method of Schultze being the loss of animal heat incident to its use.

In all cases where artificial respiration is used the first movement should be that of expiration, to expel, so far as possible, foreign substances from the air passages. The movements should be made from eight to twelve times a minute, and not too forcibly, the child being kept in the hot bath between the movements, and as much as possible during them. As long as the heart beats resuscitation is possible, and the case should not be abandoned.

Inflation of the lungs is not usually of so much general value, although it is sometimes successful when all other means have failed. It may be done by the mouth-to-mouth method, or by the introduction of a catheter into the larnyx. The former is much easier, but is much less certain, since the air is liable to pass into the stomach. If, however, the head be carried pretty well backward, compression made over the epigastrium, and the nose closed, this is less likely to occur. The introduction of a flexible catheter into the larynx is by no means an easy matter even with considerable practice. The use of a stiff catheter is not so difficult, but it is capable of doing harm. A much better instrument is the laryngeal tube of Ribemont (Fig. 18). This is inserted like an intubation tube. By means of the rubber bag attached, air may be forced into the lung, or mucus aspirated from the trachea and bronchi as may be desired. In all these methods, but especially when the catheter is used, care is necessary not to employ too much force. It should always be remembered that the ca-

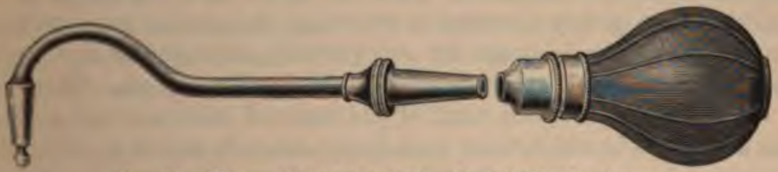

FIG. 18.—Ribemont's laryngeal tube for inflating the lungs.

pacity of the lungs of the child is much less than that of those of the physician. Like artificial respiration, inflation is to be used in connection with the external application of heat, preferably the continuous hot bath.

A method lately introduced by Laborde, of making rhythmical traction upon the tongue eight to ten times a minute as a means of exciting respiration, is one of the most efficient within our reach. It may be resorted to in conjunction with other methods, or used alternately with them.

In cases of asphyxia it is not enough to make the child cry. The deep respirations must be made to continue, for very often it happens that resuscitation is only partial, and that the child after six or eight hours lapses into its previous condition. All severe cases require careful watching for the first twenty-four or thirty-six hours, as a repetition of the treatment is often required.

CHAPTER II.

CONGENITAL ATELECTASIS.

This condition is one in which there is a persistence of the fœtal state in the whole or in any part of the lung.

Atelectasis is the pathological condition with which asphyxia of the newly born is usually associated. In most of the cases the condition of atelectasis is completely overcome by the means employed in resuscitation; in some, however, these means are only partially successful, so that a portion of lung of variable extent remains in the fœtal condition. These are the circumstances in which most of the cases of atelectasis arise. But there are others in which there is no history of early asphyxia, where the primary respirations, although taking place spontaneously, have not been of sufficient force and depth to produce full pulmonary expansion. This usually occurs in feeble infants, or in those who are premature. The causes of congenital atelectasis are therefore, in the main, those mentioned as producing asphyxia.

Lesions.—In cases where the child dies during the first few days the amount of expanded lung is often very small, frequently not more than one fourth of the pulmonary area. The expanded portion is usually the anterior borders of the upper lobes. This is often the seat of acute emphysema. The rest of the lung is still in the fœtal state; it is of a brownish-red colour, very vascular, does not crepitate, and shows the lobular outlines both on the surface and on section. With a little force the atelectatic lung may be completely inflated.

If children have lived several months, nearly the whole of the upper lobes and the anterior portion of the lower lobes are usually well inflated. These portions are either normal or slightly emphysematous. The posterior portion of the upper lobes and the lower lobes are almost invariably the seat of the atelectasis. On the surface even these portions may present quite a large area of expanded vesicles, but the lobe is solid to the touch, and crepitates but slightly. On section it is seen that only the most superficial part of the lung is inflated, often only to the depth of a line, while the interior of the lobe is unexpanded. Small hæmorrhages are frequently seen beneath the pleura.

It is usual for both lungs to be affected, and often, but by no means uniformly, to about the same degree. It is frequently a great surprise to discover that a child has lived two or three months without presenting any signs of cyanosis, using not more than one third of its pulmonary area. This variety of atelectasis closely resembles the hypostatic pneumonia of delicate infants, and very often the two conditions are associated. It may require the microscope to decide between them. If congenital atelectasis has existed for some months, there are usually found evidences of pneumonia. Inflation is not so easy as in recent cases, but with force the greater part of the lung can usually be expanded. The heart commonly shows the right auricle and ventricle to be distended with dark clots, and there is occasionally found a patent foramen ovale or some other form of congenital lesion. The liver and spleen are in most cases congested, and the spleen may be considerably enlarged. The mucous membrane of the stomach and intestines is sometimes deeply congested.

Symptoms.—In one group of cases the children are asphyxiated at birth, but the attempts at resuscitation have been only partially successful. Although the patients may live for a few days, there is cyanosis, which gradually deepens, and death takes place from asphyxia, exhaustion, or convulsions.

In a second group of cases the infants have been asphyxiated at birth, and resuscitated perhaps with difficulty, but to all appearance completely. They do not thrive, however, remaining small and delicate, gaining very little or not at all in weight, and showing poor circulation, cold extremities, and occasionally subnormal temperature. It is characteristic of these cases that the cry is never loud, strong, and lusty. Some of them will not cry at all. Such children may live several weeks, or even months. There may develop at any time, often quite suddenly and without assignable cause, attacks of cyanosis with prostration. Children may have several such attacks, which do not excite suspicion since they pass away spontaneously. In other cases the symptoms are so severe that they may result fatally in a few hours, death being frequently preceded by convulsions. If energetically treated the symptoms may pass away but, reappearing in a few hours, or again after a week or more, they gradually deepen in intensity until death occurs.

Two cases coming under my observation in the New York Infant Asylum in 1890, illustrate this point. The infants were twins, ten weeks old and delicate. Suddenly at night one child was taken with convulsions, became deeply cyanosed, and died in two and a half hours. It had been suffering from a slight attack of indigestion and diarrhœa for a week previous, but apparently was not seriously ill. The other twin had been on the previous day as well as for several weeks. Two hours after the death of the first child the second was taken with similar symptoms, dying in a few hours. At autopsy I found very extensive atelectasis involving the posterior part of the upper and the greater part of both lower lobes. The lesions were almost identical in the two cases. In both, the stomach was greatly distended with food and gas. I have repeatedly seen the effect of overdistention of the stomach in producing cyanosis in young children, and in this instance I believe it to have been the exciting cause of the final symptoms. It was subsequently learned that during the six weeks of observation the nurse had witnessed several slight attacks of cyanosis in one of the infants.

I have seen a number of such cases, in which there was nothing whatever to attract attention to the lungs until the final attack of cyanosis occurred, the children showing only the signs of malnutrition. In not all of these cases is there a history of asphyxia at birth. Some are only puny, delicate or premature, exhibiting during the early weeks of life all the signs of feeble vitality. The subsequent course is the same as in those in which there is early asphyxia. The duration of life in these cases depends chiefly upon the extent of the atelectasis.

It is not to be supposed that all cases of congenital atelectasis terminate fatally. Infants in whom there is every reason to believe that atelectasis exists, from the occasional attacks during the first few weeks of cyanosis, feeble cry, poor circulation, etc., may under favourable conditions recover completely, even though no special treatment is directed to the lungs.

Diagnosis.—For this the physical signs are of much less value than the symptoms. It should be remembered that the principal seat of the disease is the lower lobes posteriorly. Percussion usually gives resonance over the entire chest, although this may be somewhat diminished posteriorly. There is not, however, so much change as one would expect to find, for the collapsed areas are surrounded by others which are overdistended, and there are in the midst of the collapsed parts, especially upon the surface, lobules which are inflated. If the two sides are involved to about the same degree, as is often the case, we can get no difference in the percussion note over the two lungs, and the change from the normal may be so slight as not to be appreciable. Where only one lung is affected a difference can usually be made out. The respiratory murmur is rarely bronchial, but generally only feeble in its intensity, and rather ruder in quality than normal. As in the case of percussion, if only one lung is affected this is of some value in diagnosis, but it is not sufficiently marked to be readily recognized when both sides are involved. Occasionally râles are present.

Treatment.—In the newly-born child, whether asphyxiated or not, the physician should see to it that the infant not only cries, but does so loudly and strongly, and that this cry is repeated every day. If children do not cry naturally they must be made to do so by the alternate use of the hot and cold bath, as in cases of asphyxia, or by mechanical means, like spanking. This should be repeated at least twice a day, and continued for from fifteen to thirty minutes. It may seem cruel, but it is often the only means of saving life. Expansion of the lungs is much more easily induced during the first few days of life, becoming more and more difficult the longer it is delayed. Provided the condition is recognized, treatment is fairly successful. In institutions where delicate infants spend most of the time in their cribs, atelectasis is likely to be found. An infant needs exercise, and this is often only to be obtained by taking the child from its crib several times a day, by general friction, massage, the stimulus of fresh air, etc. Nothing is more certain to perpetuate atelectasis than to allow the infant a life of feeble vegetative existence. Food and feeding must be carefully attended to, but even these are of less importance than the maintenance of the animal heat. The temperature is often subnormal, and should be closely watched. If there is difficulty in keeping the child warm it should be rolled in cotton and surrounded by hot bottles, or kept in an incubator during the first few weeks. (See page 10.) During attacks of cyanosis the same means are to be employed as in cases of asphyxia of the newly born—cutaneous stimulation and artificial respiration—the administration of drugs being of little or no value.

CHAPTER III.

ICTERUS.

Several varieties of icterus are met with in the newly born.

1. It is often seen in the various forms of pyogenic infection. In such cases the icterus is usually mild.
2. It may depend upon syphilitic hepatitis—a rare cause.
3. It may be due to congenital malformations of the bile-ducts.
4. The most frequent of all varieties is the so-called idiopathic icterus, sometimes spoken of as "physiological" icterus.

In the cases included under the first and second heads icterus is a minor symptom. The other varieties are sufficiently important to require separate consideration.

MALFORMATIONS OF THE BILE-DUCTS.

The common bile-duct is the most frequently affected. There may be atresia at the point where it opens into the intestine, the duct may be represented by a fibrous cord, or it may be absent altogether. In many cases this is the only lesion; in others it is associated with an impervious hepatic or cystic duct; in still others the common duct is normal, but the cystic or hepatic ducts are impervious.

At autopsy all the organs are usually found intensely jaundiced, particularly the liver. In recent cases this is very much swollen, but presents no marked organic changes. In cases which have lasted several months there is commonly found chronic interstitial hepatitis, sometimes to a very marked degree. This was present in nine of the fifty cases collected by Thompson.* The gall-bladder is usually small, and often rudimentary. In cases of atresia of the common duct it may be greatly distended.

The condition of the bile-ducts is ascribed to an error in development and subsequent catarrhal inflammation. There does not seem to be sufficient evidence to prove that hereditary syphilis is an etiological factor of much importance. This was present in but five of Thompson's cases.

Symptoms.—The most striking symptom is jaundice, which is usually noticed a day or two after birth, and steadily increases until it becomes intense. The urine is colored a dark brown or bronze by bile pigment, and even the meconium stools may be white, except in cases where malformation is limited to the cystic duct. The liver as a rule is much enlarged. The spleen is often swollen. Hæmorrhages beneath the skin or from any of the mucous membranes are quite common. Vomiting is usually absent. In most cases there is progressive wasting, and death within the first few weeks. Of Thompson's fifty cases, nine lived less than a month, and only eighteen over four months. Lotze has reported a case of a child living eight months with an impervious hepatic duct. A frequent cause of death in the rapid cases is convulsions.

These malformations cannot be influenced by any treatment.

PHYSIOLOGICAL OR IDIOPATHIC ICTERUS.

In 900 consecutive births at the Sloane Maternity Hospital icterus was noted in 300 cases. In 88 it was intense, in 212 it was mild. According to the statistics of various lying-in hospitals of Germany, it was found in from 40 to 80 per cent. of all infants. In the 300 cases just referred to, icterus was noticed on the first day in 4, on the second day in 19, on the third day in 72, on the fourth day in 86, on the fifth day in 67, and on or after the sixth day in 44. From the second to the fifth day is therefore the usual period for its appearance.

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* Edinburgh Medical Journal, 1892.

It usually increases in severity for one or two days and then slowly disappears. The average duration in the mild cases is three or four days; in those of moderate severity about a week; in the most severe cases it may last for two weeks. The icterus is first noticed in the skin of the face and chest, then in the conjunctivæ, then in the extremities. The skin varies in colour from a pale to an intense yellow. The urine in most cases is normal. It sometimes is of a light brown colour, and only in the most severe cases does it contain bile pigment. According to Runge, both urea and uric acid are produced in larger amounts than in children not icteric. The stools are unchanged, the normal yellow evacuations occurring in the icteric as early as in those not affected.

According to some observers, in infants who are icteric the initial loss in weight is greater and the subsequent gain slower than in other children. This is not borne out by the Sloane statistics. Of the 300 icteric children, 155 made satisfactory progress in every respect and gained rapidly. The progress in 106 cases was said to be "fair"—i. e., at the time of discharge, usually on the tenth day, a slight gain in weight was noted. The remaining 39 did badly, not gaining in weight and showing other symptoms of malnutrition. The proportion of icteric infants who did well, moderately, and badly, was practically the same as of the other children in the institution not suffering from icterus. Icterus occurs with equal frequency in both sexes. According to Kehrer, it is more frequent in first children than in later ones, and considerably more frequent in premature children than in those born at term. The presentation, the duration of labour and its character—whether natural or artificial—have no influence upon the production of icterus. As a rule icteric children appear in other respects healthy, but in those below the average size the icterus is apt to be more intense.

Few subjects have given rise to wider speculation than this form of icterus. Its exact pathology is at present unknown. Of the many theories advanced, that of Silbermann is perhaps the most satisfactory—viz., that the icterus is due to resorption, and is hepatogenous in its origin. With this view Frerichs and Schultze agree. Silbermann explains the resorption by the existence of stasis in the capillary bile-ducts which are compressed by the dilated branches of the portal vein and the blood capillaries. The change in the circulation of the liver is one of the results of the change in the blood which occurs soon after birth. This results from an extensive destruction of the red blood cells—a kind of blood fermentation. The more feeble the child the more intense the icterus, because the blood changes are more intense. In consequence of this destruction of red blood cells abundant material for the formation of bile pigment exists and accumulates in the hepatic vessels.

In jaundiced infants who have died from accident or other causes the skin and almost all the internal organs are found icteric. There is also staining of the internal coat of the arteries, the endocardium, the pericardium, and the pericardial fluid. Sometimes the subcutaneous connective tissue is yellow, also the brain and cord; the spleen and kidneys only in the most severe cases. In the kidneys uric-acid infarctions are often found, and sometimes bile pigment. The liver is rarely discoloured. The bile-ducts are normal. In certain cases Birch-Hirschfeld has discovered bile pigment in the liver cells.

This jaundice is never fatal, and is not serious. Other conditions, such as atelectasis, may coexist, which may make the case grave. The chief point in diagnosis is not to confound physiological icterus with that depending upon other more serious conditions, such as sepsis or congenital malformation of the bile-ducts. In sepsis other symptoms are present, usually an abnormal condition of the umbilicus, and the symptoms appear at a later date. In malformation of the bile-ducts the jaundice is very intense, and is frequently accompanied by marked hepatic enlargement.

Physiological icterus requires no treatment.

CHAPTER IV.

THE ACUTE INFECTIOUS DISEASES OF THE NEWLY BORN.

It is possible for the newly-born infant to suffer from almost all of the common infectious diseases. Smallpox probably has been most frequently observed. In rare instances measles, influenza, typhoid fever, malaria, and pneumonia have occurred in the first days of life. As the mothers in many instances were suffering from the diseases during or just prior to delivery, the infants appear to have been infected before birth through the circulation of the mother. In other cases, especially in pneumonia and influenza, infection may take place soon after birth. The symptoms of these diseases in the newly born differ little from those occurring in any young infant. The prognosis, however, is very much worse on account of the tender age and feeble resistance of the patient.

In addition to the diseases mentioned, there are other forms of infection which belong especially—some of them exclusively—to the newly born. We shall consider: (1) The Pyogenic Diseases, which are due to the entrance of pyogenic germs; in this class are to be included Ophthalmia and Erysipelas; (2) Tetanus; and (3) diseases probably infectious, but as yet not proved to be so—Acute Fatty Degeneration, Epidemic Hemiglobinuria, and Pemphigus.

THE ACUTE PYOGENIC DISEASES.

This group of diseases—known also as puerperal fever of infants, or sepsis in the newly born—presents a great variety of symptoms and lesions. They have, however, the one feature in common, viz., that they result from the entrance of pyogenic bacteria* into the body of the child. The two micro-organisms most frequently causing the suppurative processes are the staphylococcus pyogenes aureus and the streptococcus. These are probably the exciting cause of four-fifths of the cases. The remainder are due to one or more of the other bacteria which cause suppuration. The germs may be found alone, or they may be associated with others. In the investigations made thus far the streptococcus has been most frequently found. This was discovered by Prudden in the dust of a ward in the New York Infant Asylum, where several cases had occurred, also in an umbilical abscess, and in the pseudo-membranous sore throat of one of the cases. Of a group of three cases, all occupying the same bed at the Sloane Maternity Hospital, one was studied bacteriologically by Prudden, and showed only streptococci. A case of meningitis occurring in the same hospital was studied by Van Gieson, who found in cultures from the exudate only streptococci, which were also present in the umbilical vessels. The streptococcus was discovered by Allard in cases of osteomyelitis. In three recent cases of my own, all with multiple joint suppuration, the staphylococcus was found in two and the streptococcus in one—in every case in pure culture. The severity of the symptoms depends somewhat upon the nature of the bacteria which excite the disease, the form being usually milder when due to the staphylococcus than when due to the streptococcus. Still more important, however, is the degree of virulence of the bacteria at the time of infection. Thus the streptococcus sometimes excites only a very mild, and at others a most violent inflammation.

Most frequently the avenue of entrance is the umbilical wound. This obtains probably in four fifths of the cases. It may be through an abrasion of the skin, such as often exists about the anus or genitals, through a wound about the scalp or body inflicted during instrumental delivery, through erosions of the mucous membrane of the mouth, or through the eyes. Infection through the milk is denied by some writers. Although it has been shown that in a great proportion of the cases the milk of a woman suffering from mastitis or from septicæmia contains pyogenic germs, still the taking of these into the stomach is very unlikely to infect the infant. Karlinski has reported a fatal case, in which the milk appeared to be the means of infection, and by experiments on animals he proved the possibility of infection in this manner. Bacteria may be aspirated during or after labour, giving rise to septic pneumonia. The source of the poison may be other septic cases in an institution, either among infants or mothers. It may be carried by the physician, the nurse, the instruments, or the dressings.

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* There were formerly described cases of "septicæmia" in the newly born; but restricting this term to its present significance—an infection due to bacterial products only—septicæmia is of doubtful occurrence at this period, unless we include as such some of the forms of diarrhœal disease. The cases of "sepsis" in the newly born studied by modern methods have shown with great uniformity the presence of pyogenic bacteria.

Infection through the umbilicus may occur either before or after the separation of the cord. The poison may enter through the umbilicus, although this may give no external evidence of disease. This was true in a case recently studied by Van Gieson, in which the infant died of meningitis when eight days old. The cord had healed properly, and at the autopsy the navel appeared normal. It was accidentally discovered that the umbilical vessels inside the body contained pus. From this the meningitis evidently arose, as the same bacteria were found by culture both there and in the brain. Entering through the mouth, bacteria may lead to infectious processes in the throat, or spreading downward may involve the stomach and intestines, rapidly producing death; or the alimentary tract may be the focus from which infection of distant parts may arise.

Clinical Varieties.—*Omphalitis.*—In this variety there is inflammation of the umbilicus, and cellulitis of the abdominal wall in the immediate neighbourhood. This results in the formation of an umbilical phlegmon. It may terminate in resolution, in abscess, or in gangrene. The usual termination is in abscess. These abscesses may be small and superficial, or they may be more deeply seated between the abdominal muscles and the peritonæum. Omphalitis usually begins in the second or third week of life, before the umbilicus has cicatrized. Locally there are redness, swelling, and induration. The process may result in abscess, there may be diffuse inflammation of the abdominal walls of an erysipelatous character with extensive sloughing, or the infection may spread to the peritonæum.

Inflammation of the umbilical vessels.—This is one of the most frequent primary processes in pyæmic infection. The umbilical arteries are more frequently involved than the vein. According to Runge, inflammation of the vessels is always preceded by inflammation of the connective tissue which surrounds them, as the poison is taken up by the lymphatics and not by the blood-vessels. Omphalitis is frequently present, but in some cases the umbilicus shows nothing abnormal.

In arteritis the vessels may be involved to any degree: sometimes only a short distance from the abdominal wall, sometimes quite to the bladder. They contain pus, and often septic thrombi. Saccular dilatation is frequently present at several points. Pus sometimes exudes from the umbilical stump on pressure. The other lesions accompanying arteritis are those of pyæmic infection, more or less widely distributed. There are frequently peritonitis, suppuration of the joints, erysipelas, multiple abscesses of the cellular tissue, sometimes suppurative parotitis. Atelectasis is common. Pneumonia was found in twenty-two of Runge's fifty-five cases.

In cases of phlebitis, the umbilical vein is usually involved for its entire length from the abdominal wall to the liver. This may lead to an acute interstitial hepatitis going on to suppuration, or to phlebitis of the portal vein and some of its branches. In either case there is more or less parenchymatous hepatitis, and often multiple abscesses of the liver, most of the patients being jaundiced. Peritonitis also is a frequent complication.

Peritonitis.—This is one of the most frequent pathological processes in pyæmic infection, and is very often the cause of death. It is generally associated with umbilical arteritis, and often with erysipelas. In a considerable number of cases it is the most important lesion found. It may be localized or general. Localized peritonitis is generally in the neighbourhood of the umbilicus or of the liver. It may result in adhesions, or in the formation of peritoneal abscesses. More frequently the peritonitis is general, and resembles the septic peritonitis of adults. There is a great outpouring of lymph coating the intestines and other viscera and the inner surface of the abdominal wall, causing adhesions between the abdominal contents. Collections of sero-pus are found in the pelvis and in various pockets formed by the adhesions. Sometimes blood is present in the exudation.

The special symptoms which indicate peritonitis are vomiting, abdominal tenderness and distention, and protrusion of the umbilicus. The abdominal enlargement is chiefly from gas, but may be partly from fluid. There are present thoracic respiration, dorsal decubitus, and flexion of the thighs as in all varieties of acute peritonitis. The temperature is usually high.

Pneumonia.—The most common form seen is pleuro-pneumonia. There is an abundant exudate of grayish-yellow lymph covering the lung. Occasionally collections of pus are found in the sacs formed by the adhesions. Serous effusions are rare. The pulmonary lesion consists usually in a broncho-pneumonia, with consolidation of larger or smaller areas in the lungs—more often in the upper than in the lower lobes. It is not uncommon for minute abscesses to be found in the lung at various points. There is a purulent bronchitis of the larger and smaller tubes.

The symptoms are obscure and often indefinite. The only characteristic ones are cyanosis and rapid respiration, with recession of the chest walls on inspiration. The physical signs are inconstant and uncertain. Pneumonia cannot usually be diagnosticated during life. In most of the fatal cases of pyogenic infection, whatever its type, there is found some involvement of the lungs. The changes are most extensive in cases in which the serous membranes are involved.

Pericarditis is rare and usually associated with pleurisy. Endocarditis is very rare. Hirst has, however, reported a case.

Meningitis.—The pia mater is the least liable to be affected of all the serous membranes, with the possible exception of the pericardium. When meningitis is present it is usually associated with peritonitis or with pleurisy. The lesions are those of acute purulent meningitis with a copious exudation, sometimes associated with meningeal hæmorrhages, or with acute encephalitis and the production of multiple minute abscesses in the cortex. The local symptoms are usually not marked, and are sometimes very obscure. The most characteristic are stupor, strabismus, dilated pupils, opisthotonus, bulging fontanel, convulsions, and occasionally localized paralyses. The temperature is generally high.

Gastro-enteritis.—Diarrhœa is a frequent symptom in all septic cases, constipation being rarely present. In many instances vomiting is a prominent symptom. In a small proportion of cases the most important local lesions are in the intestines, generally in the nature of a superficial catarrhal inflammation.

Pseudo-membranous inflammations of the throat.—These are rarely seen in the newly born. In 1888 J. Lewis Smith made a report on a group of five cases occurring as a small epidemic in the New York Infant Asylum. They were associated with other lesions, and all were fatal. In several cases there was omphalitis. One of these was studied biologically by Prudden, who found no Loeffler's bacilli, but streptococci both in the exudation in the throat and in the umbilical abscess. The streptococcus was cultivated from the dust of the ward, and it is probable that this was the nature of the infection in all the cases. These throat inflammations are to be regarded as one manifestation of a general streptococcus infection.

Osteomyelitis.—Allard * has reported a series of cases in which, after the general and local symptoms of pyogenic infection had existed for some time, suppuration occurred over various bones, especially the humerus, tibia, metatarsal bones, sacrum, etc. Trephining revealed the lesions of osteomyelitis. The abscesses usually made their appearance between the fourth and the sixth week. The most rapid case died on the fourteenth day, and none lasted more than two-and-a-half months.

Joint suppuration.—In certain pyæmic cases, and in some in which there are no other symptoms, acute suppuration in the joints occurs without any change in the bones themselves. This may come on very acutely in the first or second week, or more slowly as late as the third or fourth week. A single joint may be involved, or at times almost every articulation in the body. I have recently seen four cases of this kind. In one, a shoulder and one temporo-maxillary articulation were involved; in another, a shoulder and hip; in the remainder there were multiple lesions affecting nine or ten joints, including the elbows, ankles, and sterno-clavicular joints, together with the wrists, fingers, and toes.

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* Thèse, Paris, 1890.

Abscesses in the cellular tissue.—These are quite frequent, and may occur with suppuration in the joints or internal organs, or they may exist as the only lesion. They may be found where the adipose tissue is scanty, as over the heels, the elbows, and the malleoli; also in the thighs, the ischio-rectal region, and sometimes in the abdominal walls. They are nearly always multiple. They vary in size from that of a small pea to one containing half an ounce of pus. They are due to the introduction of pyogenic germs, usually staphylococci. Their course is benign, and they require no treatment except incision and cleanliness. Where there is a disposition to their continued formation, the skin should be washed with an antiseptic solution.

Erysipelas.—This is seen especially during the first two weeks of life, and most frequently starts from the umbilicus, although it may follow any wound or abrasion of the skin. When originating at the umbilicus it is generally complicated by other lesions, such as peritonitis and umbilical phlebitis. If it start from any other part of the body it may be uncomplicated. It is now pretty well agreed among bacteriologists that the difference between the streptococcus pyogenes and the streptococcus of erysipelas is in the degree of their virulence. While we have the two extremes well marked—typical erysipelas on the one hand, and simple cellulitis terminating in a circumscribed suppuration, on the other—we have all the intermediate grades of severity between them.

Erysipelas starting at the umbilicus gives rise to an area of induration, with a redness which is quite sharply circumscribed. It may be superficial, or it may involve the deeper tissues. It may terminate in diffuse suppuration or in gangrene. The erysipelas of the newly born tends to spread with rapidity, often extending over nearly the whole trunk. The general symptoms are great prostration, high temperature—from 102° to 105° F.—localized pain and tenderness, great restlessness, wasting, vomiting, and diarrhœa. The disease is always serious, and when starting from the umbilicus usually fatal. The prognosis is better in cases originating elsewhere, but under all conditions the disease is a very serious one.

Distribution of the Lesions.—The frequency of the different visceral lesions in eighty-seven autopsies published by Bednar was as follows: Peritonitis in twenty-nine, pneumonia in fifteen, pleurisy in ten, meningitis in nine, meningeal hæmorrhage in eight, encephalitis in eight, cerebral hæmorrhage in four, entero-colitis in five, pericarditis in four. In thirty-one cases there was umbilical arteritis, and in nine cases umbilical phlebitis. There was one case each of pulmonary hæmorrhage, pleural hæmorrhage, acute hydrocephalus, acute bronchitis, and suppuration in the cellular tissue. Runge's later observations of thirty-six cases showed umbilical arteritis in thirty, umbilical phlebitis in three, and normal umbilicus in three. He found pneumonia in twenty-two of fifty-five cases. Other lesions frequently associated are atelectasis, swelling and softening of the spleen, cloudy swelling of the liver and kidneys, occasionally with foci of suppuration in these organs. The blood is dark, and coagulates imperfectly.

General Symptoms.—These may begin at any time during the first ten days—very rarely after the twelfth day. Fever is an exceedingly variable symptom—it may be very high; it may be almost absent; occasionally there is subnormal temperature. The course of the temperature is very irregular. Wasting is constant and quite rapid. It depends upon the inability to take and digest food, upon the intestinal complications, and upon infection. In quite a number of cases wasting is almost the only symptom. Icterus is exceedingly common; in many of the worst cases it is intense. It is met with where the liver is the seat of an acute parenchymatous or acute suppurative inflammation, and in many other cases where it depends apparently upon the blood changes. Hæmorrhages are common, and may be the direct cause of death. They are most frequent from the umbilicus, from the intestine, and into the subcutaneous cellular tissue. They may occur in almost any organ or from any mucous membrane. Nervous symptoms are generally present, and are sometimes marked. They are restlessness, rolling of the head, a constant whining cry, twitchings of the muscles of the extremities or face, stiffening of the body, more rarely general convulsions. Late in the disease, dulness and stupor are present. The pulse is rapid and weak and the respirations are often irregular even when there is no cerebral complication. Diarrhœa is frequent; the stools are green, brown, sometimes black from the presence of blood, and are often very foul. Vomiting is less common.

In addition to these there are symptoms due to the various forms of local inflammation—peritonitis, meningitis, pneumonia, subcutaneous suppuration and gangrene, these all being found in varying degrees and in various combinations.

Prophylaxis.—Pyogenic infection of the child, like puerperal fever in the mother, may be considered a preventable disease. Its occurrence is usually due to a failure to carry out proper rules regarding cleanliness and asepsis in connection with delivery. The statistics of the Moscow Lying-in Asylum, published by Miller in 1888, show that previous to the general introduction of antiseptic methods, from six to eight per cent of all infants born in the institution died from some variety of infection. In twenty-three hundred successive labours at the Sloane Maternity Hospital, in New York, up to January, 1893, not a single marked case occurred.

From these figures it will be evident that in the vast majority of cases the occurrence of a case of infection of a serious nature, is the fault of the physician or nurse in attendance.

The umbilicus should be cleansed and treated like any other fresh wound. Dry dressing should invariably be employed, and antiseptic gauze or salicylated cotton in preference to household linen. If suppuration occurs at the time the cord separates, the parts should be cleansed daily with 1–3,000 bichloride solution, and powdered with iodoform. All wounds of the face, scalp, and other parts should be treated in the same way. The ligatures and everything which comes in contact with the umbilical wound should be sterilized. Careful attention should be given to the mouth, genitals, and all the muco-cutaneous surfaces, to prevent excoriations and intertrigo. Finally, every septic case occurring in an institution should be immediately isolated. A nurse in charge of a septic woman should not have the care of the infant.

Prognosis.—Pyogenic infection in the newly born, even in its mildest forms, is a serious disease, and in its severer forms is almost invariably fatal. Few cases recover in which there is present any form of visceral inflammation.

Treatment.—The treatment of cases of pyogenic infection practically resolves itself into the treatment of individual symptoms as they arise. Wherever suppuration occurs, external abscesses should be evacuated and treated antiseptically. For the local inflammations of the lungs, peritonæum, and brain, little or nothing can be done in the way of direct treatment. The condition is one to be prevented, but not cured. The general indications are to sustain the patient by proper feeding and the use of stimulants whenever required by the pulse. For local use in erysipelas, nothing, in my experience, is better than a ten-per-cent ointment of ichthyol made up with lanoline, kept constantly applied. When affecting only one of the extremities, the treatment by the Kraske method, of making scarifications beyond the line of redness and covering with wet bichloride dressings, is sometimes successful, but this is not applicable to cases involving the trunk.

OPHTHALMIA.

Ophthalmia of the newly born is to be classed among the pyogenic diseases. It usually consists in a purulent conjunctivitis. In the more severe cases there may be ulceration of the cornea, and even perforation into the anterior chamber of the eye.

The infectious nature of this ophthalmia is now fully established. In the most severe cases the micro-organism generally found has been the gonococcus; but in the milder forms the gonococcus is absent, and any of the common pyogenic germs may be found. In the gonorrhœal cases the infection occurs during labour from the secretions of the mother, from the examining fingers of the physician, or from instruments; or after birth from infected cloths and other materials which come in contact with the eye. Healthy lochia produce only a catarrhal inflammation. The infection occurring after birth may take place at any time. That due to gonorrhœal infection from the mother is generally manifested on the third day, and is often violent from the outset.

The symptoms are swelling of the lids, chemosis, copious purulent discharge, sometimes hæmorrhages from the lids, ulceration and there may even be sloughing of the cornea. The course of the disease depends upon the cause and upon the treatment employed. In the cases not due to the gonococcus the course is generally benign, and with ordinary cleanliness usually results in recovery without any permanent damage to the sight. The gonorrhœal cases, unless energetically treated from the outset, are very frequently followed by permanent loss of vision. The best statistics upon the causes of blindness in adults show that from twenty-six to thirty per cent of such cases are due to ophthalmia in the newly born. This disease is occasionally complicated by other symptoms of gonorrhœal infection of a pyæmic nature. Widmark, Lucas, and Davies-Colley have reported cases followed by acute articular symptoms.

Prophylaxis is of the utmost importance. Credé's statistics show that in 1874 the frequency of ophthalmia in his lying-in hospital was 13·6 per cent. In the three years ending 1883, among 1,160 newly-born children only one or two cases occurred. The method of prophylaxis which he adopted consists in dropping into the eyes of every child, immediately after birth, one or two drops of a two-per-cent solution of nitrate of silver. The general adoption of Credé's method, or of some similar means of disinfection, has resulted in a very great diminution in the frequency of ophthalmia throughout the world. These prophylactic means should be obligatory in all institutions, and should be used in all cases in private practice wherever there is any possible suspicion of the existence of gonorrhœa. In all other cases the eyes should be carefully cleansed with a saturated solution of boric acid. The use before delivery of an antiseptic vaginal douche is theoretically indicated, but practically it has been found to be inadequate to the prevention of the disease.

Treatment.—Everything which comes in contact with the eyes should be carefully disinfected. All cloths, cotton, etc., used for cleansing should be immediately burned. The strictest antiseptic precautions should be insisted on to prevent the spread of the infection by nurses. In institutions containing infants, severe cases of ophthalmia should always be isolated. The most important thing is to keep the eyes clean. In severe cases they must be cleansed every twenty minutes, night and day. It is best accomplished by means of an eye-dropper with a slightly bulbous tip, inserted alternately at the inner and the outer angle of the eye, and the fluid injected with force sufficient to empty thoroughly the conjunctival sac. For this purpose a saturated solution of boric acid, or a 1–5,000 solution of bichloride, may be employed, the important feature being that the eye be cleansed thoroughly, and so frequently that the pus is never allowed to accumulate. Once or twice in twenty-four hours two or three drops of a one-per-cent solution of nitrate of silver should be put into the eye; or a stronger solution may be employed and immediately neutralized with a salt solution. The next most valuable means of treatment is cold. Ice-cold compresses should be employed for thirty minutes every two hours in the milder cases, while in the most severe ones they must be used continuously. These should be cooled by placing them on a block of ice, and changed at least every minute, so that they are kept cold. If the cornea is involved the pupil should be kept dilated by means of atropine, and this is wise in all severe cases.

TETANUS.

Tetanus is an acute infectious disease characterized by tonic muscular spasm, which increases in severity by paroxysms occurring at longer or shorter intervals. It may be limited to the muscles of the jaw (trismus), or may affect all the muscles of the trunk, extremities, and neck.

Though many writers have sought to maintain a difference between tetanus of the newly born and tetanus of later life, whether traumatic or not, their identity has been admitted for at least a dozen years. The discovery of the exact cause of tetanus is due to the work of Nicolaïer, who in 1884 found a bacillus in the soil, with which he produced the disease in animals. He demonstrated the presence of this bacillus in the wounds of tetanus patients. Nicolaïer did not, however, obtain the germ in pure culture; but this was done by Kitasato in 1889. The bacillus is generally known as Nicolaïer's bacillus. Since that time the germ has been found in the wounds of numerous patients with tetanus, including newly-born infants.

The rapidity with which the infection spreads from the point of inoculation is very remarkable, as shown by Kitasato's experiments. Thus, if one hour elapsed after infection before cauterizing the inoculated wound, the animal succumbed to the disease. The bacilli are not found in the blood or internal organs. The symptoms of the disease have been shown to depend upon the absorption of a toxic product of the tetanus bacillus called *tetano-toxine*.

The germ of tetanus usually gains access to the body of the infant through the umbilical wound. It exists in the soil, and the disease prevails endemically in certain localities. It is common in certain parts of Long Island and New Jersey. Among the negroes in some parts of the South it has for many years occurred with great frequency. It is stated that on one of the islands of the Hebrides every fourth or fifth child dies of tetanus. In a single house in Copenhagen eighteen cases were observed. Tetanus is rare except where dirt and filth prevail; but these alone are not sufficient to produce the disease. It is a very rare disease in the tenements of New York.

Lesions.—There are no essential lesions of tetanus. Those which have been found have been partly accidental and partly a result of the disease rather than its cause. In most of the cases intense hyperæmia of the spinal cord and its membranes is found, and not infrequently small extravasations of blood. Such small hæmorrhages are occasionally found in the meninges of the brain—more frequently at the base than at the convexity. In rare instances hæmorrhages of considerable size have occurred into the brain itself. The lungs are generally congested, and the right side of the heart overdistended. In most of the cases the umbilicus has not healed, and it may present evidences of septic infection in varying degrees.

Symptoms.—These, as a rule, begin on the fifth or sixth day, or at the time of the separation of the cord. The first symptoms may not appear until the tenth or twelfth day, but rarely later than this. Generally the first thing noticed is difficulty in nursing, which, on examination, is found to be due to rigidity of the jaws (trismus). Nursing may be impossible on this account. The muscles of the jaw feel hard, the lips pout and all the muscles of the face seem firm. Soon a slight stiffening of the body occurs, the child straightening the back as it lies upon the lap and continuing rigid for a moment or two. In the interval it is at first completely relaxed. These paroxysms soon increase in frequency until they may come on every few minutes, being excited by any movement of the body. The relaxation is then only partial, and the neck and extremities, sometimes nearly the whole body, become rigid and stiff as a piece of wood. The arms are extended, the thumbs adducted, and the hands clenched. The thighs and legs are extended, and no motion is possible at the hip or knee. The jaws can be separated slightly or not at all. The firm contractions of the facial muscles give a peculiar expression to the features. There is a low, whining cry. Swallowing is difficult, sometimes impossible. The pulse is rapid and soon becomes weak. The temperature at first is normal, but in the most acute cases rises rapidly to 104° or even 106°; in the milder cases it does not go above 101° F.

Death is due to exhaustion, to fixation of the respiratory muscles, or to spasm of the larynx. In the less severe cases all the symptoms are milder, and there may be intervals in which the rigidity is scarcely noticeable, so that respiration and deglutition may be carried on for some time. In cases which terminate in recovery the temperature is but slightly elevated. The tonic contractions gradually become less severe, and the paroxysms less frequent. The children usually suffer for several weeks from the general symptoms of malnutrition, which are proportionate to the severity of the attack. Of eighty-eight fatal cases which are reported by Stadtfeldt all but five died between the ages of six and ten days. The duration of the disease in the fatal cases is seldom more than forty-eight hours, often less than twenty-four hours; in those terminating in recovery, between one and three weeks.

Prognosis.—No disease of infancy is more fatal than tetanus. Where it prevails endemically it is regarded by the laity as so uniformly fatal that usually no physician is called. Scattered through medical literature are quite a large number of isolated cases in which recovery has occurred. At the present time the proportion of fatal cases is probably between ninety and ninety-five per cent. Sporadic cases more frequently recover than those occurring in districts where the disease is endemic. The later the development of the symptoms, the slower their course, and the lower the temperature the more likely is the case to recover.

Prophylaxis.—A proper understanding of the nature of the disease has brought with it the means of rational prevention. The first essential is obstetrical cleanliness, which must include scissors, hands, dressings, ligatures—in short, everything which comes in contact with the umbilical wound. In districts where tetanus is endemic, thorough antiseptic treatment of the umbilicus should be insisted upon, both at the first dressing and later, particularly at the time of the separation of the cord.

Treatment.—All drugs whose physiological action is that of motor depressants of the spinal cord have a certain amount of value in tetanus. The most important ones are chloral, the bromides, and calabar bean. Nearly all the reported cures have been by one of these drugs or a combination of them. The mistake usually made is in using too small doses to be of any efficacy. Enough to produce the physiological effects of the drug must be given. The initial dose should not be large, but it should be repeated until the full effects are obtained. Of those mentioned, chloral has been the one most generally relied upon. An hourly dose of one or two grains is usually required. If no effect is visible in ten or twelve hours the dose may be further increased, as the patient is in much greater danger from the disease than he can possibly be from the drug. Chloral may be given by the mouth or by the rectum, but must always be well diluted. The single case of recovery which I have witnessed was one treated by the bromide of potassium. This infant took eight grains every two hours for three days, afterwards smaller doses. Calabar bean has the advantage in that its extract may be given hypodermically; one tenth of a grain may be administered from three to ten times daily, according to the severity of the symptoms. Monti has reported two cases cured by its use. The child must at all times be kept as quiet as possible, without unnecessary handling or bathing. If nursing or feeding by the mouth is impossible, because the jaws cannot be separated, the child may be fed by a tube passed through the nose. This is greatly to be preferred to rectal alimentation. Drugs may be administered in the same way.

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The antitoxine treatment.—Behring and Kitasato, after a series of experiments upon animals, have produced a substance called *tetanus antitoxine* which has the power of neutralizing the tetanus poison. In animals immunity is produced by its injection. It is also curative in those cases where tetanus has been induced artificially. As yet the number of cases in which this treatment has been applied to man is too small to admit of positive deductions regarding its value. The practical difficulties in applying it are great, because of the very rapid absorption of the tetanus poison from the wound. The treatment is not efficient unless it is adopted very early in the disease. This is not always easy, as cases are not common. In Italy, ten cases, chiefly of traumatic tetanus, have been reported cured by the antitoxine; but experience elsewhere has not been quite so satisfactory. In England, two cases of traumatic tetanus have been cured by the injection of the serum. Escherich has recently reported (1894) four cases of tetanus in the newly born treated by antitoxine, with one recovery, the symptoms of this case diminishing rapidly after the second injection. Papiewski treated three cases by this method, two of which recovered, but the course was such that the result could hardly be attributed to the antitoxine. The tetanus antitoxine is now prepared by Behring and by the New York Health Department; it is used subcutaneously like the diphtheria antitoxine.

EPIDEMIC HÆMOGLOBINURIA (WINCKEL'S DISEASE).

The essential features of this disease are hæmoglobinuria with icterus and cyanosis, this combination giving the skin a deeply bronzed hue (*maladie bronzée*). It is a rare disease, but has generally occurred epidemically in institutions. It is usually fatal. All the symptoms point to an acute, rapid disintegration of the red blood-cells—a sort of blood fermentation. The changes have been compared with those produced in the blood in poisoning by chlorate of potash or phosphorus. The cause is, without doubt, some sort of infection, but its exact nature has not been discovered. Although generally called by the name of Winckel,* who in 1879 made a full report upon an epidemic of twenty-three cases in a hospital in Dresden, the disease was quite well described by Charrin† in 1873, with a report of fourteen cases, and observed by Bigelow,‡ in Boston, in 1875. All the cases included in Winckel's report occurred in one institution, affecting one fourth of the children born during the period.

There are cyanosis, and a more or less intense icterus of the skin and internal organs. The umbilical vessels are usually normal. The kidneys are swollen, show small hæmorrhages into their substance, and under the microscope the straight tubes are seen to be filled with crystals of hæmoglobin, but contain no blood-cells. The bladder frequently contains brownish, smoky urine. The spleen is swollen and filled with blood pigment, which is diffused throughout the cells of the pulp, and free in the blood-vessels. Punctate hæmorrhages are seen in most of the other viscera. Fatty degeneration is at times observed in the heart and liver. Peyer's patches and the mesenteric glands are frequently swollen.

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* Winckel, Veröffentlich. der pädiatrischen Section der Gesellsch. f. Heilk., Berlin, April, 1879.

† Charrin, Thèse de Paris, 1873.

‡ Bigelow, Boston Medical and Surgical Journal, March, 1875.

This disease most frequently attacks those who have been previously healthy. The symptoms usually begin from the fourth to the eighth day after birth. They are intense and fulminating in character, seldom lasting more than two days, and often only one. The early symptoms are general restlessness, rapid pulse and respiration, prostration, cyanosis of the face, and general icterus, which is at first slight, but steadily increases until it becomes intense, the skin resembling that of a mulatto. The temperature is normal or slightly elevated. Gastro-enteric symptoms are occasionally present, but they are not a feature of this disease. There is rapid asthenia, often terminating in coma or convulsions. The most characteristic symptoms are those connected with the urine. It is passed frequently, in small quantities, with pain and straining. It is of a brown, smoky colour, and under the microscope shows hæmoglobin in considerable quantity, renal epithelium, and sometimes granular casts and blood-cells, but does not contain bile pigment. Albumin is sometimes present, but not in large quantity. Examination of the blood shows an increase of the white cells and many free granules.

Treatment is of little avail, since all severe cases die. It is to be directed against individual symptoms.

FATTY DEGENERATION OF THE NEWLY BORN (BUHL'S DISEASE).

A disease has been described by the author whose name it bears, the essential nature and causation of which are unknown. It is characterized by inflammatory changes leading to fatty degeneration in the viscera, especially the heart, liver, and kidneys; it seldom lasts more than two weeks, and is almost invariably fatal. There may be hæmorrhages in any of the viscera, into the serous cavities, or from any mucous membrane. In the lungs are found large or small hæmorrhagic infarctions, and the bronchi contain blood and bloody mucus. There is granular or fatty degeneration of the epithelial cells of the alveoli. In cases that have lasted some time, the heart-muscle is pale, soft, and fatty. The liver in recent cases is large and soft; in those of longer standing it is pale and jaundiced, and shows marked fatty degeneration. The spleen is large and soft. The stomach and intestines contain blood, and the mucous membrane shows ecchymoses. The epithelium of the tubules of the kidney is fatty, and the tubes are choked with granular and fatty detritus. The umbilicus is normal, but often there are hæmorrhages into the neighbouring tissues. Many of the lesions are similar to the ordinary post-mortem changes, and when found they should not be interpreted as pathological unless the autopsy has been made within at least twelve hours after death.

The disease occurs most frequently in patients who have previously presented the symptoms of asphyxia, which to a greater or less degree have persisted. In other respects the infants may be strong and well-nourished. The symptoms develop gradually. Those most constantly present are vomiting of blood, bloody stools, icterus, and œdema which may affect only the dependent parts, or may be general. When the cord separates there is often bleeding at the umbilicus. The constitutional symptoms are prostration, rapid loss in weight, and all the evidences of malnutrition. There is no appreciable rise in temperature. External hæmorrhages may be wanting altogether. Death occurs from progressive asthenia or hæmorrhage. The clinical features resemble those of pyogenic infection, but in Buhl's disease the umbilicus is healthy, aside from occasional hæmorrhages, and there is no rise of temperature. The disease occurs in isolated cases, not in groups. The treatment is entirely symptomatic.

PEMPHIGUS.

Pemphigus is a term used to designate a lesion rather than a disease. By it is meant an eruption of bullæ occurring usually upon a red base, the contents being in most cases clear serum. The term has been made in the past to include several different diseases even in the newly born.

1. Traumatic pemphigus is a condition which has been induced by putting infants into very hot baths.

2. Pemphigus is seen as one of the lesions of congenital syphilis. In these cases the eruption is often present at birth. It rarely appears after the fourteenth day. The bullæ are often seen upon the palms and the soles, but may be present on any part of the body. These infants are usually in a wretched condition, and die in a few weeks, often in a few days.

3. There is a variety of pemphigus which seems clearly due to infection. This has been observed in small epidemics in institutions. Quite a number of such epidemics have been seen in Europe, but none that I am aware of have been reported in America. Koch reports twenty-three cases occurring in two years in the practice of one midwife, she herself being probably the source of infection. The same writer states that in two cases the disease developed upon the breasts of mothers who were nursing affected children. While the infectious character of the disease is pretty generally admitted, the exact nature of the exciting cause has not yet been

determined. Strelitz discovered in the exudate two varieties of pathogenic cocci. Demme found diplococci.

The clinical picture presented by this form of pemphigus is so striking that the disease can scarcely be mistaken. The symptoms begin in most cases between the third and sixth day of life. There is a bullous eruption, which appears upon the abdomen, neck, face, or thighs. It is commonly seen first upon the trunk. Usually there are but ten or twenty bullæ present; but nearly the whole body may be covered except the palms and soles, where they are rarely seen. They may even appear upon the conjunctiva or the mucous membrane of the mouth. The single vesicles vary in size from one fourth to one or two inches in diameter. They are usually rounded, with a reddened base. The contents may be clear or cloudy. The small vesicles may coalesce and form very large bullæ. Rupture usually occurs in one or two days, and there is left a moist red surface, which quickly dries. After the falling off of the crust there remains a red or violet patch upon the skin. The eruption may come out quite rapidly, almost at once, or the disease may be prolonged, the bullæ appearing in crops for from one to three weeks. If ulceration occurs the duration of the disease may be considerably lengthened. In many particulars the pemphigus resembles impetigo contagiosa, with which it has no doubt often been confounded.

The principal point in diagnosis is to distinguish between syphilitic and non-syphilitic pemphigus. The latter usually occurs in well-nourished infants, and has a much better prognosis. In infants previously healthy it usually ends in recovery when the bullæ are few in number; but if they develop rapidly over a large surface the outlook is very unfavourable.

The treatment consists in absolute cleanliness, and in the use of absorbent antiseptic powders, such as equal parts of boric acid and starch, to dry up the eruption, or antiseptic lotions, such as 1 to 10,000 bichloride, or a one-per-cent solution of ichthyol.

CHAPTER V.

HÆMORRHAGES.

HÆMORRHAGES are quite frequent during the first days of life, and are important not only from the fact that they are often the cause of death, but, when the brain is the seat, from their remote effects. There are several conditions in the newly born which predispose to bleeding—the extreme delicacy of the blood-vessels, and the great changes taking place in the blood itself and in the circulation in the transition from intra-uterine to extra-uterine life. Hæmorrhages may complicate many of the diseases of the early days of life, such as syphilis or sepsis, or they may exist alone.

The cases may be divided into two groups: (1) Traumatic or Accidental Hæmorrhages, which depend upon causes connected with delivery; (2) Spontaneous Hæmorrhages, or The Hæmorrhagic Disease of the Newly Born.

TRAUMATIC OR ACCIDENTAL HÆMORRHAGES.

These are mainly due to pressure in natural labour, or to means employed in artificial delivery, but some of them may possibly result from injuries received before birth. Their position is influenced by the presentation and the nature of the means employed in delivery. They are more frequent in large children, in difficult labours, and where from any cause the body of the child has been subjected to undue pressure. The most important of these are hæmatoma of the sterno-mastoid, cephalhæmatoma, and certain of the single visceral hæmorrhages, which may be intracranial, thoracic, or abdominal.

Hæmatoma of the Sterno-Mastoid.—Hæmatoma, or, as it is sometimes called, induration of the sterno-mastoid muscle, leads to the formation of a tumour in the belly of the muscle. It is a rare condition, usually noticed in the second or third week of life, and it disappears spontaneously, without causing any permanent deformity. The tumour varies from three quarters of an inch to one inch and a half in length, being about the size and shape of a pigeon's egg. It is movable, almost cartilaginous to the touch, and sometimes slightly tender. The situation of the tumour is usually about the centre of the muscle. There is no discoloration of the skin.

In about two thirds of the cases it occurs after breech presentations. It is much more frequent upon the right than upon the left side. In twenty-seven cases collected by Henoch the right side was involved in twenty-one and the left in only six cases. The explanation of this difference is to be found in the obstetrical position. Rarely, both sides may be involved. The head is usually inclined towards the shoulder of the affected side and rotated towards the opposite side. The tumour is frequently discovered by accident. Often it is the slight rotation of the head which is first noticed. Hæmatoma of the sterno-mastoid is frequently mistaken for an enlarged lymphatic gland; its position, however, is diagnostic. The swelling slowly diminishes in size, and in most cases by the end of the third month has entirely disappeared. Occasionally a slight torticollis remains for a longer time, but in the majority of cases the recovery is perfect. Hæmatoma of the sterno-mastoid is due to the twisting of the head during parturition. It is not an evidence of the employment of any improper violence in delivery. The twisting of the head produces laceration of some of the blood-vessels of the muscle, and in some cases there is doubtless rupture of some of the fibres of the muscle itself. Following this there occurs a certain amount of inflammation of the muscle and its sheath. The tumour is due partly to blood-extravasation and partly to inflammatory products. In one or two recent cases in which the sheath of the muscle has been opened it has been found filled with blood. Usually the inner border of the muscle is the part most affected.

The prognosis for complete recovery is good. The condition requires no treatment. Operative interference is positively contra-indicated.

Cephalhæmatoma.—This is a tumour containing blood, situated upon the head, usually over one parietal bone, and tending to spontaneous disappearance by absorption. The source of the blood is the rupture of the small vessels of the pericranium.

Etiology.—Cephalhæmatoma is sometimes due to a distinct traumatism like the application of forceps or to some other injury during labour. In the majority of cases, however, there is no evidence of such injury, and the cases are regarded as of spontaneous origin. Several etiological factors are probably present. Besides the conditions predisposing to all hæmorrhages, there is the increased pressure in the blood-vessels of the head during delivery, especially when labour is prolonged or difficult; there may be changes in the bone, such as an imperfect development of the external table, which has been found in a few instances, and in consequence of which the periosteum readily separates when the head is subjected to the pressure of the pelvis; and, finally, there may be changes in the blood itself. Cephalhæmatoma is a comparatively rare condition, being present, according to the statistics of the Sloane Maternity Hospital, in 20 of 1,300 consecutive births, or 1·6 per cent. This is rather more frequent than is stated by European observers. The condition is more common after first labours, after difficult labours, and in vertex presentations. It occurs twice as often in males as in females, probably from the greater size of the head in male children.

Lesions.—In the 20 Sloane cases, the situation was over the right parietal bone in 12; over the left in 2; over both parietals in 4; over the occipital in 2. The location of the tumour seems to have a very close relation to the position of the head in the pelvis. In 8 of the right-sided cases the head was in the left occipito-anterior position; in 3 it was in the right occipito-anterior; in 1 case the position was unknown. Of the cases with occipital tumours, both were breech presentations. Of the 16 cases with a single tumour the labour was natural in 10, tedious in 4, and in 2 forceps were used. Of the 4 double cases, 2 were forceps deliveries, 1 a tedious labour, and but 1 was natural.

In rare cases triple tumours are met with, one over each parietal and one over the occipital bone. The attachment of the periosteum along the sutures, usually limits the tumour to the surface of one bone. It never extends across the sutures or over the fontanel. In cases where there is a more definite injury, such as the forceps, the tumour may be present over any one of the cranial bones, but more frequently over the parietal. The seat of the hæmorrhage is between the periosteum and the cranium. The scalp shows punctate hæmorrhages and sometimes infiltration with blood. In recent cases the blood is fluid; later it is coagulated. There is often developed about the blood-clot a sort of cyst wall which limits its extension. The bone is roughened, and there are at times small bony plates in the under surface of the periosteum. The amount of extravasated blood is usually from half an ounce to an ounce. In extreme cases it may be from four to six ounces. The cases following natural delivery are generally uncomplicated. The traumatic cases may be complicated by extravasations between the bone and the dura (internal cephalhæmatoma), or by meningeal or cerebral hæmorrhages. If there is a wound, infection may be followed by purulent meningitis and even by cerebral abscess.

Symptoms.—The tumour is usually noticed from the first to the fourth day after birth, appearing as a slight prominence in one of the positions indicated. Gradually increasing in size, it attains its maximum at the end of a week or ten days, and then slowly diminishes. In the average case the tumour is about the size of a hen's egg, and is oval in form. In marked cases it may be one third the size of the child's head. To the touch it is soft, elastic, fluctuating, and irreducible. It does not increase with the cry or cough. There is no extra heat and no sign of inflammation. Usually the tumour does not pulsate, although in rare instances pulsating cephalhæmatomata have been seen. Very soon the tumour is surrounded by a marginal ridge. At first this is apparently from coagulation of blood, but later it may be bony. The prominent ridge with the soft centre gives a sensation somewhat like that of a depressed fracture. Sometimes on pressure there is obtained a sort of parchment-crackling. This is generally found as the swelling is subsiding, and is sometimes clearly due to the formation of minute bony plates upon the inner surface of the periosteum. It may be found when there is nothing but thin coagula to explain it. In certain cases following severe traumatism, cephalhæmatoma may be complicated with wounds of the scalp, fracture of the skull, and even lacerations of the dura mater or the brain. In such cases the tumour may become inflamed, but in the spontaneous cases this is extremely rare. The usual signs of abscess develop, which may open externally or burrow. Fortunately this termination is seldom seen.

As a rule, without any interference, the uncomplicated cases go on to recovery. The complete disappearance of the tumour may be expected in from six weeks to three months, depending on its size; but a hard, uneven elevation may remain at its site for a longer time. The cases due to severe traumatism are more serious, the gravity depending not upon the cephalhæmatoma but upon the complicating lesions.

Diagnosis.—Cephalhæmatoma may be confounded with encephalocele. This, however, occurs along the line of the sutures or at the fontanels, is partly reducible, pressure causes cerebral symptoms, and frequently the tumour increases with respiratory movements. Hydrocephalus is distinguished by the symmetrical enlargement of the head, the large frontanels, and the widely separated sutures. Caput succedaneum often appears in the same place as a cephalhæmatoma and at the same time, but is an œdematous, not a fluctuating tumour, is not circumscribed, lacks the hard, marginal border, and begins to disappear by the second or third day. From a depressed fracture of the skull, it is differentiated by the fact that in cephalhæmatoma there is a tumour and not a depression; the prominent margin which is raised above the contour of the skull, is not osseous and the skull can be felt at the bottom of the centre of the tumour.

The *treatment* in the uncomplicated cases is simply protective, all such cases tending to spontaneous recovery. No local or general treatment to promote absorption is required. The child should be so placed and so handled that no injury may be done to the affected part. Compresses are unnecessary. If complications exist, such as injury to the bones, dura, or brain, they are to be treated in accordance with general surgical principles. Operative interference is called for only when suppuration has occurred, or when there are brain symptoms which point to the existence of internal as well as external cephalhæmatoma.

Visceral Hæmorrhages.—While these are most frequent in large children and following difficult labours, they may occur in small children and where the labour has been easy and normal—their occurrence here being due to the feeble resistance of the blood-vessels. From one hundred and thirty autopsies upon still-born children or those dying soon after birth, Spencer concludes that intracranial hæmorrhages are more frequent in head-forceps than in breech cases, and more frequent in breech than in natural vertex deliveries. Other visceral hæmorrhages are much more frequent in breech cases.

Not all visceral hæmorrhages are to be classed as traumatic. They are often seen with the spontaneous hæmorrhages from the skin or mucous membranes. When, however, they are single, they seem to me of traumatic rather than of pathological origin.

The most important of the visceral hæmorrhages are intracranial. These are discussed in the chapter devoted to Birth Paralyses. Rarely there may be large hæmorrhages into the lung. Here the blood fills the air vesicles, the small bronchi, and coagula may be found even in the larger bronchi. A large part of a lobe or an entire lobe may be involved. On section the condition resembles atelectasis, and it may give the physical signs of consolidation.

The abdominal viscera suffer more than those of the thorax because less protected against pressure. Small hæmorrhages are not uncommon upon the surface of any of the viscera covered by peritonæum. Intraperitoneal hæmorrhages are rare, but may be very extensive, amounting to one or two pints. Sometimes no ruptured vessel can be found. The hæmorrhage may be primarily in the peritoneal cavity, or it may result from rupture of one of the viscera, especially the suprarenal capsule. It may be large enough to produce death from loss of blood.

Small surface hæmorrhages of the liver are not infrequent. Occasionally one of considerable size occurs separating the peritoneal covering and forming a tumour generally upon the superior surface. Such laceration may be produced during labour, and a slow accumulation of blood may take place beneath the capsule, death resulting, as in the case reported by Mendelson (New York), from rupture into the peritoneal cavity on the third day. Steffen reports a case of laceration of the capsule of the liver in a still-born infant. Of the large hæmorrhages, those into the suprarenal capsules are perhaps the most frequent. Two cases have recently occurred in the Sloane Maternity Hospital. In one of these, the specimen of which I examined, the capsule was distended nearly to the size of an orange, and the kidney surrounded by a mass of blood-clots. Blood was extravasated into the retroperitoneal connective tissue, and rupture had taken place into the peritoneal cavity, which contained half a pint of partly coagulated blood. The child died on the fifth day. This case has been reported in full by Tuley.* Ahlfeld has reported a case of hæmorrhage into both suprarenals.

Except in the intracranial variety, visceral hæmorrhages cause few symptoms, and in the great majority of cases the diagnosis is not made. Intrapulmonary hæmorrhages have given rise to the signs of consolidation of the lung and even to hæmoptysis (Miram's case). The abdominal hæmorrhages are the most obscure. There may be a general abdominal distention with the usual symptoms of loss of blood, or there may be a circumscribed swelling. In many cases nothing is noticed until a rupture of a subperitoneal hæmorrhage takes place into the general peritoneal cavity, when there may be sudden collapse and death.

The visceral hæmorrhages are not amenable to treatment. The prognosis depends upon the size and position of the hæmorrhage. In the cases of abdominal hæmorrhage the diagnosis is extremely obscure and is rarely made during life.

SPONTANEOUS HÆMORRHAGES—THE HÆMORRHAGIC DISEASE OF THE NEWLY BORN.

A disposition to bleeding is seen with many diseases of the first few days of life, especially those of an infectious character, like syphilis and pyæmia. With most of these, however, the hæmorrhages are small, and the condition may be compared to the hæmorrhagic tendency seen in certain forms of infection of later life, such as measles, smallpox, and malignant endocarditis. There is, however, a class of cases in which the hæmorrhages are not associated with any other known process, and in which the escape of blood from the small blood-vessels is the chief or essential symptom. In these cases the bleeding is much more extensive than in the others mentioned. These hæmorrhages are characterized by the fact that they are spontaneous in origin, having no connection with delivery, they are multiple in location, and, while little influenced by treatment, they tend to cease spontaneously after quite a limited time. They are most often from the umbilicus, the mucous membranes of the stomach and intestines, or beneath the skin, but they may be from almost any mucous surface or into any organ of the body.

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* Archives of Pædiatrics, November, 1892.

Etiology.—Exactly what causes these hæmorrhages is as yet unknown, but it is something which produces changes in the blood or in the blood-vessels, or in both, whereby the vessels are no longer able to hold their contents. In this class, as well as in the traumatic hæmorrhages, the predisposing causes of bleeding in early life must be emphasized—viz., the fragile condition of the blood-vessels and the great changes taking place soon after birth both in the circulation and in the blood itself. These hæmorrhages are not common, and are met with much more often in institutions than in private practice. In 5,225 births in the Boston Lying-in Asylum, Townsend reports 32 cases of hæmorrhage, or 0·6 per cent. In the Lying-in Asylum of Prague, Ritter observed 190 cases in 13,000 births, or 1·4 per cent. In the Foundling Asylum of Prague, Epstein reports hæmorrhages in 8 per cent of 740 infants.

These cases, except in very rare instances, are not manifestations of hæmophilia. Of 576 bleeders collected by Grandidier, only 12 had a history of hæmorrhage at the time of falling off of the cord, and symptoms very rarely appeared before the end of the first year. Hæmorrhages in the newly born are more frequent in males, while in hæmophilia females predominate, 13 to 1. The hæmorrhagic disease of the newly born is self-limited, and runs a definite course to recovery or death. The tendency to bleed does not extend beyond a few weeks, and often lasts but a few days; those who survive, recover perfectly. Circumcision has been done within a few days after the cessation of the hæmorrhages without any unusual bleeding. In a case lately under observation with the most extensive subcutaneous hæmorrhages I have ever seen, all tendency to bleed had ceased before the separation of the cord, although there had previously been bleeding at the navel. A similar case is reported by Townsend. These cases are not associated with difficult delivery. In only 6 of Townsend's* 50 cases was the labour abnormal. This is borne out by my own experience. Many of the children who bleed have previously been anæmic and in poor general condition; but, on the other hand, many have been strong and given every indication of being well nourished. Hereditary syphilis is associated in a small proportion of the cases—from 2 to 6 per cent, according to the observations of Epstein, Ritter, and Townsend. In 132 cases of congenital syphilis observed by Mracek, 14 per cent suffered from hæmorrhages.

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* Archives of Pædiatrics, 1894, p. 559.

A more frequent association with sepsis has been observed. Of the 61 cases observed by Epstein not less than 29, and of the 190 cases of Ritter,* 24 were associated with sepsis. In the Sloane Maternity Hospital, New York, in 1,500 consecutive births no case of hæmorrhage worth mentioning occurred, and during this period there was not a single case of marked sepsis among the infants born in the hospital. During the past year (1895) there have been no less than 8 marked cases of hæmorrhage in the Nursery and Child's Hospital in about 225 deliveries. While it is true that more cases of sepsis (pyogenic infection) have occurred among the children during this period than is usual, it is striking that not one of these hæmorrhagic cases gave any evidence of sepsis, and that none of the septic cases had bleeding.

From the foregoing facts it is quite evident that not all the cases of bleeding are due to the same cause, and that while this symptom occurs in cases of pyogenic infection, the latter does not explain most of the cases seen. The circumstances in which the hæmorrhagic disease occurs point strongly to an infectious origin, but with our present knowledge we cannot believe this cause to be the same as in ordinary sepsis—viz., the entrance of common pyogenic bacteria. Bacteriological findings thus far have not been altogether conclusive. The most important results were obtained in two cases studied recently by Gaertner.† In both of these there was found in the blood a short bacillus resembling in some respects the bacterium coli commune, but differing from it in several important points. This bacillus, injected into the peritoneal cavity in young animals, chiefly dogs a few days old, produced a disease accompanied by hæmorrhages resembling that seen in the newly born. The bacillus was recovered from the blood and all the organs of these animals. In a recent case occurring at the Nursery and Child's Hospital, cultures were made eight hours after death by Dr. J. J. Mapes. There was found in pure culture in the umbilical arteries, in the heart's blood, and in the spleen, a bacillus which in morphological and culture characteristics was apparently identical with that described by Gaertner. It will, however, be necessary that many other cases shall be recorded before the etiological connection between this germ and the disease is established.

While these hæmorrhages are not traumatic, bleeding is exceedingly prone to occur in the skin over pressure points such as the back, the elbows, the occiput, and the sacrum. It is also common from the mucous membranes which are the seat of pathological processes, especially from the eyes, the nose, and the genitals.

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* Œsterreiches Jahrbuch für Pädiatrik, 1871, 127.

† Archiv für Kinderheilkunde, 1895.

Lesions.—In very many of the cases the autopsy shows nothing except the hæmorrhages in the various situations and the blanching of the organs due to the loss of blood. The hæmorrhages of the brain are usually meningeal and diffuse. They are considered more at length in the chapter upon Birth Paralyses. The pulmonary hæmorrhages are usually small and unimportant, amounting only to small extravasations into the substance of the lung or ecchymoses of the mucous membrane of the bronchi. Ecchymoses may be seen upon the surface of the pleura, the pericardium, or the peritoneum, but large hæmorrhages into the pleura or pericardium are very rare. The thymus gland is often the seat of small extravasations. The stomach and intestines may contain considerable blood variously disorganized in the different parts of the canal, and there may be ecchymoses of the mucous membrane. In addition, ulcers may be found in the stomach and duodenum. In twenty-four autopsies upon cases with hæmorrhage from the stomach and intestines collected by Dusser,* ulcers were found in the stomach in nine cases, and in the intestines in four. These ulcers are multiple and are small, resembling the follicular ulcers of the colon. They are usually superficial, but may extend to the muscular coat and may even perforate. I have myself found ulcers in the stomach in a single case. They were associated with a moderate amount of follicular gastritis. The intestinal ulcers are found only in the duodenum and resemble those of the stomach. The cause of these ulcers is somewhat obscure; some of them are undoubtedly dependent upon inflammatory changes probably of infectious origin; others have been compared to the peptic ulcers of later life, and are attributed to thrombi in the blood-vessels of the mucous membrane. These ulcers are found in but a small proportion of the cases in which bleeding occurs from the alimentary tract, and they may be wanting even where it has been very profuse.

Small extravasations may be seen upon the surface of the liver, the spleen, or the kidneys. They may also be found in the substance of these organs. The large hæmorrhages upon the surface of the liver, into the suprarenal capsules and other subperitoneal extravasations have been included, improperly perhaps, in the group of traumatic hæmorrhages discussed in the preceding chapter. From a rupture of any of these there may be large extravasations into the peritoneal cavity. Microscopical examinations of the blood-vessels have been made in but a small number of cases. Mracek claims to have found evidences of endarteritis in some of the syphilitic cases in which there was bleeding. The changes found in the blood have not been uniform and have as yet been only imperfectly studied. The associated lesions found are most frequently those due to sepsis.

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* Thèse, Paris, 1889.

Symptoms.—The time of beginning is most frequently in the first week of life, rarely after the twelfth day, although it has been observed as late as the sixth week. As a rule, the hæmorrhages from the stomach and intestines begin earlier than those from the navel or the skin. The location of the hæmorrhage in Ritter's 190 cases was as follows: Umbilicus, 138 (umbilicus alone, 97); intestines, 39; mouth, 28; stomach, 20; conjunctivæ, 20; ears, 9. In Townsend's 50 cases: Intestines, 20; stomach, 14; mouth, 14; nose, 12; umbilicus, 18 (umbilicus alone, 3); subcutaneous ecchymoses, 21; abrasion of skin, 1; meninges, 4; cephalhæmatoma, 3; abdomen, 2; pleura, lungs, and thymus, 1 each.

In many cases nothing is noticed until the hæmorrhage begins. The child may be previously healthy or feeble. The first bleeding noticed may be from the stomach, intestines, or any of the mucous surfaces, beneath the skin, or from the umbilicus. The amount of blood lost in most cases is not great, but there is a continuous oozing. The total hæmorrhage may be only one or two drachms or it may reach several ounces. The skin is usually pale, the pulse feeble, and the general condition one of considerable prostration, often from the outset. In all cases there is rapid loss of weight. The temperature may be high, low, or subnormal. A marked elevation of temperature may depend not upon the hæmorrhage but upon associated conditions. Fluctuations in temperature during the first three days are so common from disturbances of nutrition, that I attach much less importance than have some writers to this symptom. Icterus is not more frequent than among other infants. In a large number of the cases there is diarrhœa. Convulsions often occur at the close of the disease.

The duration of the disease in cases which recover is usually but one or two days. In fatal cases it is rarely more than three days, and often less than one. Death more frequently results from the gradual failure of all the vital forces than from a rapid loss of blood.

Umbilical hæmorrhage.—A slight oozing from the umbilicus not infrequently occurs when the ligature has been improperly applied, or when there is so much shrinking of the cord that the ligature has loosened. Sometimes rough handling at the time of the separation of the cord may excite a little bleeding. All the above conditions, however, are usually of trivial importance and are readily controlled by simple measures. Spontaneous hæmorrhage is quite a different matter. It is rather later than bleeding from the mucous membranes, usually occurring between the fourth and the seventh day. There may be bleeding into the cord as well as from its free extremity before it separates; after separation, from the stump. A slight stain upon the dressing is usually the first note of warning, but in exceptional circumstances a gush of blood is the first symptom. The hæmorrhage may be temporarily arrested by various means, but it shows a strong tendency to recur in spite of everything which is done. The general symptoms depend upon the amount of bleeding and the rapidity with which it occurs. It is the same as in other hæmorrhages of the newly born. The usual duration is two or three days. It has been known, however, to persist for twelve or fourteen days, and it may be fatal in less than twenty-four hours from the time it is noticed.

Hæmorrhage from the stomach and intestines.—This occurs much less frequently from the stomach than from the intestines. The latter is called melæna. Gastro-enteric hæmorrhages begin, in the great majority of cases, during the first three days of life. Of Dusser's 75 cases, the hæmorrhage began on the first day in 24 cases; on the second day in 22 cases; on the third day in 9 cases; in only 10 cases later than the ninth day, and in no instance later than the twelfth day. The appearance of the blood vomited depends upon the length of time it has remained in the stomach. Usually it is in dark brown masses, and not very abundant; more rarely bright red blood may be ejected. The quantity varies from one drachm to half an ounce. Vomiting is liable to be excited by nursing. The blood discharged from the bowels is always dark coloured, usually intimately mixed with the stool, very rarely in clots. If in doubt between blood and meconium, one should look for the corpuscles with the microscope. When this is not conclusive on account of the disorganization of the corpuscles, a chemical test for hæmoglobin should be made. Concealed hæmorrhage into the stomach may take place, which may even be sufficient to produce death, no blood being vomited or passed by the bowels. In such cases the autopsy may reveal quite a large quantity of blood, both in the stomach and intestines.

Hæmorrhage from the mouth.—The quantity of blood is rarely large; but it is here that it is often first seen. Its source may be the mucous membrane of the mouth, pharynx, œsophagus, stomach, or bronchi. It may be associated with ulceration of the hard palate, with thrush, or with fissures of the lips.

Hæmorrhages from the nose are infrequent, and are more often due to syphilis than to other causes. These are rarely profuse, but are frequently repeated.

Subcutaneous hæmorrhages.—These may appear in places exposed to pressure, such as the sacrum, heels, occiput, or back; or in others which are not so exposed, as the abdomen, axillæ, or thighs. They may follow other lesions of the skin, such as pemphigus, eczema, or furunculosis. In some cases these hæmorrhages are very extensive, as in one recently under observation, where nearly one third of the thorax was covered. The extravasations are surrounded by an indurated border. Where they occur alone or form the principal lesion, the prognosis is favourable.

Hæmaturia.—The urine is not only stained with blood, but sometimes contains clots. This hæmorrhage may have its origin in the bladder, urethra, or kidney. Blood coming from the kidney is sometimes due to the irritation of uric-acid infarctions, and may have nothing to do with the general hæmorrhagic disease.

Hæmorrhage from the conjunctiva.—The blood usually comes in drops from between the eyelids, chiefly from the tarsal surface. It is generally preceded by conjunctivitis.

Hæmorrhage from the ears may originate in the external meatus or the middle ear. It is generally preceded by otitis.

Hæmorrhage from the female genitals.—This not infrequently occurs without hæmorrhages elsewhere, and under such circumstances is rarely serious. Cullingsworth has collected thirty-two cases in children under six weeks of age—no case having resulted fatally. These are not to be regarded as cases of precocious menstruation. They are frequently preceded by catarrhal inflammations of the vagina.

Diagnosis.—This is generally easy, as the hæmorrhages are usually multiple and some of them external. A slight hæmorrhage from the intestine may be easily overlooked. Large hæmorrhages into the internal organs also are obscure and not often recognised. Spurious hæmorrhages from the stomach may occur as in the vomiting of blood which has been swallowed during parturition or sucked from the breasts. Bleeding may take place from the mouth, nose, or pharynx, and, after being swallowed, the blood may be vomited. When the principal bleeding is from the nasal mucous membrane, syphilis should be suspected.

Prognosis. — In all circumstances the hæmorrhage disease in the newly born has a bad prognosis. Of seven hundred and nine cases collected by Townsend, the mortality was seventy-nine per cent. No observer has seen more than one third of his cases recover. In any single case the prognosis depends upon the extent and severity of the hæmorrhage, upon the vigour of the child, and upon how well it can be nourished. No case should be looked upon as hopeless, for perfect recovery has repeatedly taken place where it seemed impossible.

Treatment.—The administration of drugs internally for the control of hæmorrhage is, in my opinion, entirely without influence upon the disease. The general treatment should have reference to maintaining the nutrition by careful feeding, judicious stimulation, and attention to the circulation, the body temperature, and the general condition of the child. External hæmorrhages may be treated locally. Bleeding points on the skin or mucous membranes within reach, are best treated by the application of chromic acid fused on a probe, or of nitrate of silver. Umbilical hæmorrhage is best controlled by covering the umbilicus with a small pad of sterile cotton, over which is folded from either side the skin of the abdominal wall. This is held in place by two strips of adhesive plaster crossing the umbilicus obliquely. After ligature *en masse* secondary hæmorrhage often occurs at the separation of the slough, so that the procedure is frequently unsuccessful. The actual cautery is open to the same objection. There are a few instances on record where bleeding has been controlled by covering the wound with plaster of Paris. Astringents are applicable to all cases of external hæmorrhage—from the nose, skin, vagina, and the eyes. Astringent injections for gastro-enteric hæmorrhages are practically useless, as the blood is almost invariably either from the stomach or from the upper part of the small intestine.

CHAPTER VI.

BIRTH PARALYSES.

Birth paralyses are chiefly due either to pressure upon the child by the parts of the mother or to artificial means employed in delivery. They may be cerebral, spinal, or peripheral.

Cerebral paralyses are in almost every instance due to meningeal hæmorrhage. Very infrequently they depend upon cerebral hæmorrhage, laceration of the brain, or pressure from a depressed fracture.

Spinal paralyses are extremely rare, and only a few examples are on record. They are due to laceration of, or hæmorrhage into the cord or its membranes. These lesions produce paraplegia, the exact distribution of which depends upon the point at which the cord is injured.

Peripheral paralyses usually affect the face or the upper extremity. Paralysis of the face is due in most cases to the application of the forceps. Paralysis of the upper extremity is most frequently of the "upper-arm type," and is known as Erb's paralysis. It usually follows extraction in breech presentations. Peripheral paralysis of the lower extremity is almost unknown.

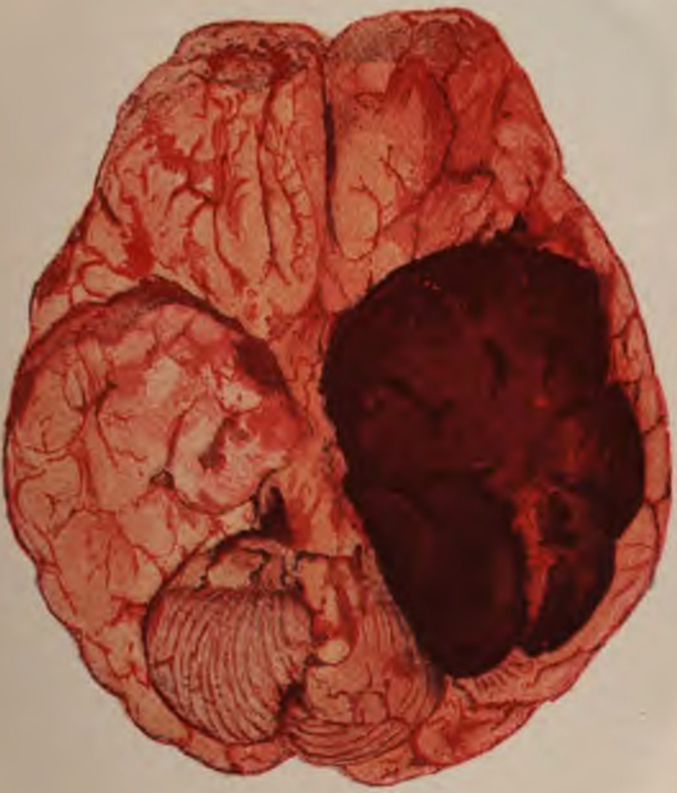
CEREBRAL PARALYSIS.

Cerebral paralysis is often used synonymously with meningeal hæmorrhage. This lesion is not infrequent, and is of great importance not only from its immediate effects, but because upon it depend many of the cerebral paralyses seen in later life. According to Cruveilhier, at least one third of the deaths of infants which occur during parturition are due to this cause.

Etiology.—The same predisposing causes exist in the cases of meningeal hæmorrhages as in others occurring at this time. A small number of cases are associated with syphilis; others with pyogenic infection. In a few cases there is a history of an injury—usually a fall or blow upon the abdomen—during the last months of pregnancy. Meningeal hæmorrhage may occur as one of the lesions in the hæmorrhagic disease of the newly born. The most important causes, however, are connected with parturition. These hæmorrhages are essentially mechanical, and are favoured by everything which increases or prolongs pressure upon the head. The conditions with which they are associated are tedious labour, breech presentations with difficulty in extracting the head, instrumental deliveries, and premature births. The majority occur in first-born children. Certain cases are associated with cardiac malformations—according to Bednar, a small aorta with hypertrophied heart, or the transposition of the large blood-vessels. In many of the cases there is also a hæmorrhage outside the skull.

Lesions.—These hæmorrhages are very much more common at the base than at the convexity, and at the posterior, than at the anterior part of the skull. They are most frequently found over the cerebellum and the occipital lobes of the cerebrum. The entire extravasation is often beneath the tentorium. The extent of the hæmorrhage is exceedingly variable. There may be a single large clot at the convexity or at the base (Plate II), the hæmorrhage may be limited to the convexity of one hemisphere, or it may cover nearly the entire surface of the brain. Diffuse hæmorrhages are more common than a single circumscribed clot. Of eleven recent cases collected by McNutt (New York), in seven cases with vertex presentations the lesion was principally at the base, and usually limited to that region. In four breech cases, however, it was principally at the convexity. The source of the blood may be a laceration of one of the sinuses of the dura mater caused by the overlapping of the parietal bones. This was found in one of the cases of Hirst (Philadelphia). Much more frequently the blood comes from one of the cerebral veins, or from the capillary vessels of the pia mater. In thirty-seven of Bednar's fifty-two cases, the extravasation was beneath the pia mater. In the remainder it was between the pia mater and the dura—i. e., in the arachnoid cavity. Hæmorrhages between the dura and the skull may be said never to occur except when associated with fracture. If the child is still-born, or if death has occurred on the first or second day, the blood is partly fluid and partly coagulated; later it is entirely coagulated and may have undergone partial absorption. The amount of extravasated blood varies between one drachm and four ounces, the average amount being about one ounce. The blood extends into the fissures between the convolutions and sometimes into the ventricles along the choroid plexus, although this is rare. In large hæmorrhages the brain substance is softened and in places may be quite disintegrated; but with small extravasations these changes are very slight. In cases which survive for two or three weeks there is usually a certain amount of meningitis. The later changes—those of arrested development of the cortex and cerebral sclerosis—will be considered in the chapter devoted to Cerebral Pa-

PLATE II.



MENINGEAL HÆMORRHAGE IN THE NEWLY BORN.

From a patient in the Nursery and Child's Hospital, dying on the sixth day. Primary respirations poor; child very dull and apathetic, refused to nurse; once vomited blood and had an ecchymosis of the right conjunctiva. On the last day, high temperature (105° F.) and general convulsions. Some changed blood found in the stomach and intestines at the autopsy; brain greatly congested, and at the base was the clot shown in the picture.

ralyses in the section on Diseases of the Nervous System. Hæmorrhages into the membranes of the upper part of the cord are found in a large proportion of the fatal cases. Associated hæmorrhages of the lungs and other organs are not uncommon.

Symptoms.—If the hæmorrhage is large, the child is usually still-born, although its movements may have been active up to the commencement of labour. When the hæmorrhage is not so large as to be immediately fatal, the child may show no symptoms except dulness or torpor, with feeble or irregular respiration, death following within the first twenty-four hours. A large proportion of the cases are born asphyxiated, and frequently they are resuscitated only after considerable effort. They nurse feebly, often with great difficulty. Convulsions are common in cases which last for four or five days, and more with cortical hæmorrhages than with those at the base. Opisthotonus is sometimes present, and may be very marked. The limbs may be rigidly extended, and the hands clenched. More rarely there is complete relaxation of all the muscles. Sometimes there are automatic movements. The respiration is usually disturbed; in most cases it is slow and irregular. The pulse is feeble and slow. The pupils are more frequently contracted than dilated, and there may be oscillation of the eyeballs. In large hæmorrhages there is marked bulging of the fontanel, and often separation of the sutures. If the hæmorrhage covers one hemisphere, there is hemiplegia of the opposite side. Small localized cortical hæmorrhages may cause paralysis of the face, arm, or leg, according to the position of the lesion, or localized convulsions. In large hæmorrhages at the base convulsions are rare, and death occurs early, usually in the first two days. In extensive cortical hæmorrhages convulsions and rigidity of the extremities are frequent, and life is prolonged indefinitely.

The majority of the fatal cases die within the first four days. In those lasting a longer time the symptoms are tonic spasm of the trunk, or of one or more of the extremities, localized paralysis—monoplegia, diplegia, or hemiplegia, according to the lesion—with localized or general convulsions often continuing for two or three weeks and gradually subsiding. There is frequently a slight rise in temperature due to secondary inflammation. The mildest cases may show no symptoms at birth, and nothing abnormal may be noticed until the child is old enough to walk or talk. In those more severe there may be gradual and continuous improvement of the early symptoms, and the case may go on to complete recovery, but more frequently there results some permanent damage to the brain. The following observation of McNutt illustrates the course and termination of one of the severe cases of meningeal hæmorrhage:

Breech presentation, tedious labour, head delivered by forceps, almost continuous convulsions for the first nine days. After the convulsions there was complete paralysis of both sides of the body, not involving the face. The child never walked or spoke; the physical development was very backward; the limbs became contractured; death occurred at two and a half years, from pneumonia. The autopsy showed atrophy of the brain on both sides about the fissure of Rolando.

The main diagnostic symptoms in recent cases are stupor, rigidity, convulsions, paralysis, and opisthotonus. These vary with the extent and situation of the lesion. The minor symptoms are changes in the pupils, oscillation of the eyes, and bulging of the fontanels.

Prognosis.—Large hæmorrhages at the base are usually fatal. Quite an extensive hæmorrhage over the convexity is compatible with life. The case may recover, as far as the immediate symptoms are concerned, but with serious damage to the brain. Smaller hæmorrhages over the convexity may be followed by complete recovery, but in the majority of cases more or less injury to the brain results, the full extent of which may not be seen for many years.

Treatment.—This is mainly prophylactic, the chief indication being to shorten tedious labours by the early use of the forceps. In a large number of cases where the hæmorrhage has been attributed to the forceps, the damage has rather been the result of the long-continued pressure before they were used. Nothing can be done after delivery to limit the amount of the hæmorrhage, except to keep the child as quiet as possible and to relieve individual symptoms as they arise.

FACIAL PARALYSIS.

The usual cause of facial paralysis is the use of the forceps, but this does not explain all the cases. The etiology of those in which the forceps have not been used is still somewhat obscure. In peripheral facial palsy the nerve is pressed upon either near its exit from the stylo-mastoid foramen, or where it crosses the ramus of the jaw, at which point the parotid gland gives it but little protection in the newly born. If the lesion is in front of this point, any one of the terminal branches may be affected; most frequently it is the temporo-facial branch. As only one blade of the forceps commonly touches the face in this region, the paralysis is, as a rule, unilateral.

Roulland has reported several cases not due to the forceps. In these the pressure is believed to have been produced by the promontory of the sacrum at the superior strait, or by the ischium at the inferior strait, as paralysis followed when the head was long arrested at one of these points. It was not seen with face or breech presentations. When facial paralysis is of central origin it depends generally upon a meningeal hæmorrhage, and the arm and leg of the same side as the face are involved. It is, however, possible for a very small cortical hæmorrhage to produce paralysis of the face only. This occurred in a case reported by McNutt.

In repose, the only symptom noticed may be that the eye remains open upon the affected side, owing to paralysis of the orbicularis palpebrarum.

When the muscles are called into action, as in crying, the whole side of the face is seen to be affected. The paralyzed side is smooth, full, and often appears to be somewhat swollen. The mouth is drawn to the side not affected. In this paralysis, the tongue, of course, is not implicated. It is therefore rare that nursing is seriously interfered with.* If the paralysis is of central origin, only the lower half of the face is involved, while in peripheral paralysis, as the trunk of the nerve is injured, the upper half of the face, including the orbicularis palpebrarum, is also affected.

The paralysis is generally noticed on the first or second day of life, and does not increase in severity. Its course and termination depend upon the extent of the injury done to the nerve. Some idea of this may often be gained by the amount of injury to the soft parts, although this is not an infallible guide. In cases not due to the forceps, the paralysis is slight and disappears in a few days; the great majority of the forceps cases follow the same favourable course, the paralysis gradually disappearing without treatment in about two weeks. In more serious cases it may last for months, or it may even be permanent. The reaction of degeneration is present in these severe cases, and there may even be perceptible atrophy of the muscles. This symptom is fortunately extremely rare.

Treatment.—Nothing should be done for the first ten days except to protect the eye and keep it clean. If improvement has begun by the end of this time, the probabilities are that the case will require no treatment. If no improvement has taken place by the end of the third or fourth week, electricity should be used regularly and systematically. If the muscles respond to it, the faradic current may be employed; if not, galvanism should be used. The electrical treatment should be continued for several months, or until recovery has taken place.

PARALYSIS OF THE UPPER EXTREMITY.

When this is due to a peripheral lesion it probably never involves the entire arm, but affects only certain muscles or groups of muscles. Although commonly occurring after an artificial delivery, it may be seen in cases where the labour has terminated naturally. Roulland † has reported a case in which deltoid paralysis, occurring in a large child, was attributed to pressure upon the shoulder during labour. In vertex presentations, paralysis is most frequently due to the forceps where one of the blades has extended down upon the neck, injuring the lower cervical nerves. It may be produced by traction with the finger in the axilla. Roulland reports a unique case of paralysis of both extremities, apparently due to the cord being very tightly wound around the neck. The great proportion of all cases of paralysis of the upper extremity follow extraction in breech presentations. The injury is usually inflicted by traction upon the shoulder in the delivery of the head, or in bringing down the arms when they are above the head. In the latter case the paralysis may be double and associated with fracture of the clavicle or humerus. In shoulder presentations, paralysis may be produced by traction upon the arm itself.

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* In this connection it is to be remembered that the principal part in nursing is done by the tongue, and not by the lips.

† Paralysies des nouveau-nés, Paris, 1887.

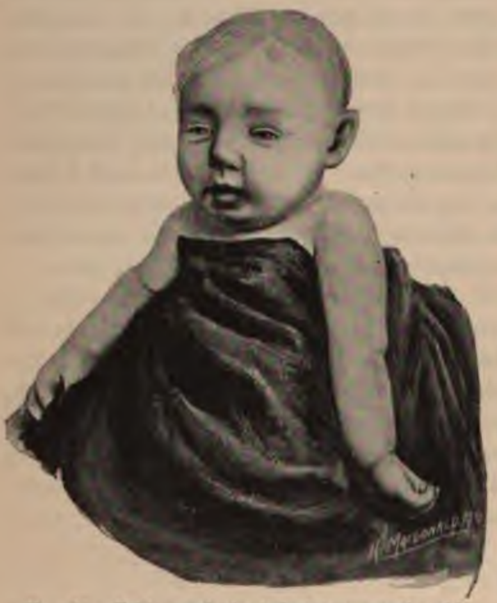

FIG. 19.—Erb's paralysis, infant two months old.

The most common form of peripheral paralysis is that known as the "upper-arm type," or Erb's paralysis, in which the injury is inflicted at the anterior border of the trapezius muscle at the lower part of the neck, usually in such a position as to affect the fifth and sixth cervical nerves. The muscles paralyzed are the deltoid, biceps, brachialis anticus, supinator longus, and sometimes the supra- and infra-spinatus. All these muscles may be involved, or only part of them, and in varying degrees. In case the injury is slight, the paralysis may not be noticed for some weeks. If severe, it is evident in the first few days. The arm hangs lifeless by the side; it is rotated inward, the forearm pronated, the palm looking outward (Fig. 19). The forearm and hand are not affected. In severe cases there may be anæsthesia of the outer surface of the arm, in the region supplied by the circumflex and external cutaneous nerves. This is rarely marked, and in its slighter degrees it is very difficult to determine. It is characteristic of this paralysis that the triceps is not affected, so that power to extend the forearm remains, although it cannot be flexed. Atrophy of the paralyzed muscles occurs after a few weeks, but the muscles are so small and so covered with fat that it is rarely noticeable before the second year. It is most conspicuous in the deltoid. In all severe cases the reaction of degeneration is present. In some of the cases of long standing there occurs a shortening of the tendon of the subscapularis muscle, often associated with subluxation of the humerus. The paralysis may be complicated with fracture of the clavicle, the neck of the scapula, or the shaft of the humerus, or with epiphyseal separation of its head.

The *prognosis* depends upon the severity of the injury and also upon the time when treatment is begun. The great majority of cases recover spontaneously in two or three months, improvement being observed within a few weeks, first in the biceps and last in the deltoid. Spontaneous recovery is not to be looked for unless it occurs within the first three months. Not infrequently some degree of paralysis persists until the third or fourth year, and in some of the muscles, usually the deltoid, it may even be permanent. If the muscles respond to faradism, rapid improvement can generally be prophesied. If the reaction of degeneration is present, improvement will be slow and the paralysis may be permanent.

The *diagnosis* is usually not difficult, since the great majority of cases are of the "upper-arm type" with classical symptoms. Peripheral palsy of the arm can scarcely be confounded with that of cerebral origin. If the lesion is central it is one of the rarest occurrences for the arm alone to be involved; either the leg or face, or both, are generally likewise affected. If the case does not come under observation until the child is a year old, it may be difficult, or without a good history, it may be impossible to distinguish peripheral paralysis from that due to polio-myelitis. The peculiar group of muscles involved in Erb's paralysis is the only diagnostic point.

In recent cases the disability resulting from the tenderness or pain of syphilitic epiphysitis may simulate paralysis, but there is lacking the characteristic position of the arm, and a careful examination discloses the fact that the paralysis is only apparent. This may affect both sides. Fracture of the clavicle or epiphyseal separation of the head of the humerus may also be mistaken for paralysis. In cases of long standing, paralysis of the deltoid may resemble dislocation of the humerus. The reaction of degeneration differentiates paralysis from surgical injuries with similar deformities.

The *treatment* consists in the use of electricity, which should be begun at the end of the first month at the latest, and used regularly. If the muscles respond to faradism this may be employed, but in most severe cases they do not, and galvanism must be used, according to the rules laid down for facial paralysis.

CHAPTER VII.

TUMOURS OF THE UMBILICUS, MASTITIS, ETC.

Granuloma.—This is nothing more than a mass of exuberant granulations at the umbilical stump. The mass is generally about the size of a pea—sometimes larger—bleeds readily, and has a thin, purulent discharge.

It is promptly cured by the application of any simple astringent; powdered alum is probably the best. In case this is not successful, the granulations may be touched with nitrate of silver or snipped off with scissors.

Adenoma, Mucous Polypus, or Diverticulum Tumour—Umbilical Fistula.—The first three terms are used synonymously to describe an umbilical tumour covered with a mucous membrane which is similar in structure to that of the small intestine. It is usually associated with an umbilical fistula. This tumour is formed by a prolapse at the navel of the mucous membrane of Meckel's diverticulum. This diverticulum is the remains of the omphalo-mesenteric duct. When it is present in infants, it is found in various stages of development. Most frequently there is a blind pouch a few inches long given off from the lower part of the ileum. In other cases it may remain patent quite to the umbilicus, causing a fæcal fistula (Fig. 20, A). As the intestine below it is generally normal, this fistula may persist for months or even years, giving rise to no symptoms except a slight fæcal discharge from the umbilicus. In certain cases intestinal worms have been discharged through it. It may close spontaneously or be closed by operation.

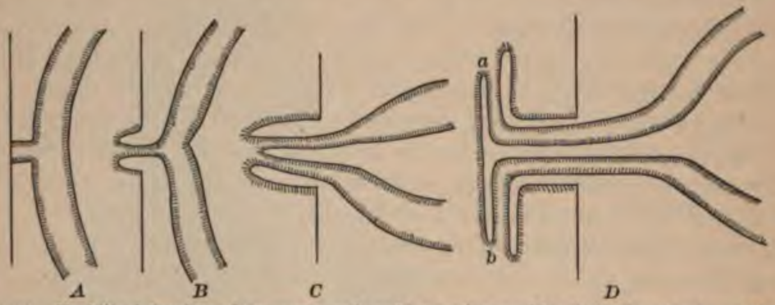

Fig. 20.—Umbilical fistula and tumours produced by prolapse of Meckel's diverticulum (Barth.)

A prolapse of the mucous membrane lining the diverticulum produces an umbilical tumour with a fistula at its summit (Fig. 20, B). This is the most common form. A cross-section shows under the microscope the structure of the intestinal mucous membrane both as an external covering and lining of the fistulous tract. The prolapse may involve not only the mucous membrane but the entire intestinal wall. There then exists a conical tumour with a fistula which has but one external opening, but at a short distance from the surface it bifurcates, one branch leading upward and one downward (Fig. 20, C). A continuation of the prolapse gives a broad pedunculated tumour (Fig. 20, D), which may reach the size of a man's fist. Its covering is the same as in the other forms. It may contain several coils of intestine. In this form there are usually two fistulous openings (*a*, *b*) which communicate with the intestine.

In all of these cases the tumour is smooth, irreducible, of a rosy pink colour, and from its surface there oozes a mucous discharge. Microscopical examination shows the external covering to be the same in structure as the intestinal mucous membrane. These tumours are generally small, varying in size from a pea to a small cherry, but they may be very much larger. A fæcal fistula usually, but not invariably, coexists.* In the condition represented in Fig. 20, B, it is easy to see how an obliteration of the fistula may occur. The small tumours are readily cured by the ligature. The larger ones are usually associated with other serious malformations of the intestines, which make the outlook bad in almost every instance.

UMBILICAL HERNIA.

This is exceedingly common, and while not often serious it is a source of great annoyance. Umbilical hernia is much more common in female children than in males, and more frequent in those who are thin and poorly nourished than in plump, healthy infants. In the majority of instances the tumour is from one fourth to one half an inch in diameter; it may, however, be very large, and may even become strangulated. Cases of congenital umbilical hernia sometimes require surgical operation because of strangulation. The ordinary cases require only mechanical treatment. The most important thing is prevention. For this purpose it is necessary, after the cord has separated, to place a firm pad over the navel, and to use a snug abdominal band for the first two or three months. After this period it is uncommon for hernia to develop. In cases coming under observation after the third or fourth month, the pad and abdominal bandage are inadequate, and other means must be employed to retain the hernia. The best of these consists in the use of two adhesive strips applied obliquely over the abdomen, crossing at the umbilicus, the skin along the median line being folded inward so as to overlap the tumour, this forming the retention pad. Another method often successful is the use of a common wooden button or a piece of lead covered with kid and held in position either by rubber plaster or an abdominal band. These must be worn constantly for several months at least. The treatment of these cases after the first year, is extremely unsatisfactory. There is no truss or other apparatus for retention which I have ever seen which was wholly satisfactory. In a small hernia where the tumour is less than half an inch in diameter it is really unnecessary to use any form of apparatus, since these cases ordinarily show little or no tendency to increase in size, and the retention apparatus causes more annoyance than the hernia. These small herniæ seem to disappear spontaneously during childhood, as they certainly are not often seen in children over seven years of age.

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* For report of such a case, and a fuller description, see article by the author, New York Medical Record, April 21, 1888.

MASTITIS.

According to Guillot, a certain amount of secretion in the breasts of the newly born is physiological. It is certainly very common. It is most abundant between the eighth and fifteenth days, but may continue in small quantities as late as the third month. It is seen with equal frequency in both sexes. The quantity of the secretion amounts in most cases only to a few drops; in some, however, as much as a drachm has been obtained. Chemical analysis has shown this secretion to be essentially the same as the adult milk—containing fat, sugar, proteids, and salts. In gross appearance it resembles colostrum. The researches of Sinéty * have shown that the mammary gland of the newly born contains cul-de-sacs lined with secreting cells, resembling those of the adult. During the period of secretion the gland is slightly reddened, its vessels turgid, and all the signs of functional activity are present. This condition in itself is of no practical importance, and in most cases, if left alone, the secretion ceases spontaneously after a week or ten days. If abundant, it can usually be dried up by painting the gland with tincture of belladonna. It sometimes happens, however, that the presence of this secretion tempts the nurse or attendant to rub or squeeze the breast. Such manipulation occasionally leads to serious results by exciting a mastitis which may terminate in abscess. Mastitis is not a very rare condition, and although the inflammation is not usually severe, it may be serious and even fatal. The predisposing cause is the congestion which accompanies functional activity, usually in the second week. The exciting cause is most often some form of traumatism—undue pressure, the squeezing of the breasts, or rough handling by the nurse. Through abrasions or fissures thus produced, micro-organisms find a ready entrance with the same result as in the adult. It seems possible that the germs may enter through the lactiferous ducts without any abrasion of the skin. Want of cleanliness is always a favourable condition for such infection.

The symptoms of mastitis usually begin during the second week of life. There are redness, swelling, and the usual signs of inflammation, which may terminate in resolution or in suppuration. The process may be limited to the mammary region, or a diffuse phlegmonous inflammation may be set up, as in a case reported by Bush,† in which there was extensive sloughing of the tissues of the whole of one side of the chest, with a fatal result. In the great majority of cases the process does not reach this degree of intensity, but suppuration with the formation of single or multiple abscesses is not uncommon. In the female it is possible for the cicatrization which follows such an inflammation to interfere with the sub-

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* Gazette Médicale, No. 17, 1885.

† New York Medical Journal, March, 1881.

sequent development of the gland. The general symptoms are restlessness, loss of sleep, disinclination to nurse, and loss of weight. In cases of diffuse phlegmonous inflammation the general symptoms are those of pyogenic infection. Jourda* has collected fifteen cases of mammary abscess, twelve of which recovered. They began between the fourth and the forty-second days. In eleven cases, only one side was involved; in four, both sides.

Mastitis is usually due to want of cleanliness or to meddlesome interference; the parts should therefore be kept scrupulously clean, and on no account should squeezing of the breasts be permitted. They should be protected by a simple cotton pad. If acute inflammation develops, it should be treated in the beginning by hot applications. Should pus form, early incision with free drainage and general tonic and stimulant treatment are indicated.

INTESTINAL OBSTRUCTION.

The most frequent causes of intestinal obstruction in the newly born are malformations of the intestine; rarely it may be due to pressure from tumours, or from a persistent omphalo-mesenteric duct or artery. The various pathological conditions present in intestinal malformations are considered in the chapter on Diseases of the Intestines. The most common seat of obstruction is at the anus, the bowel being normally formed throughout, lacking only the external orifice. The next most frequent condition is obstruction in the rectum, which may be due either to a membranous septum in the gut, or to obliteration of the tube for some distance. These rectal obstructions are readily recognised. By the examining finger or a bougie the lower limit of the obstruction can be made out, but there is no means by which the upper limit can be determined except by opening the abdomen. When the obstruction is above the rectum, localization is more difficult; but the most frequent seat is the duodenum. Of 38 cases collected by Gaertner, the seat of obstruction was the duodenum in 19 cases, the jejunum in 3, the ileum in 11, the colon in 6, the ileum and colon in 1. There is often obstruction at more than one point.

The symptoms vary with the seat and the degree of the obstruction. In atresia of the anus or rectum there is at first simply an absence of all discharges from the bowel. Later there is abdominal distention from dilatation of the sigmoid flexure and colon. After several days vomiting begins. If there is atresia of the duodenum or any part of the small intestine, vomiting begins early—usually by the second day of life—and it is persistent. Nothing is passed from the bowels after the first dark discharge of the contents of the colon, which is chiefly mucus. There is rapid asthenia, and death from inanition usually occurs in four or five days. The higher the obstruction the shorter the duration of life. If the condition is one of stenosis only, the symptoms are similar to those described but less severe, and life may be prolonged for several weeks, or even months. The constipation in these cases is not absolute. When the cause of obstruction is external pressure, the symptoms do not always begin immediately after birth. I have recently seen a child in whom nothing abnormal was noticed for the first three weeks, but at the end of that time there developed all the signs of acute intestinal obstruction. Laparotomy revealed a loop of intestine constricted by a tiny cord, which was probably the remains of the omphalo-mesenteric duct.

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* Thèse, Paris, 1889.

Cases of imperforate anus and membranous septum in the rectum are readily relieved by proper surgical treatment. In the other varieties of obstruction, whether in the rectum, in the colon, or in the small intestine, although life may be prolonged by the formation of an artificial anus, the ultimate result is almost invariably fatal, death usually resulting from marasmus during the early weeks of life.

DIAPHRAGMATIC HERNIA.

This is due to a congenital deficiency in the diaphragm, which in nearly all the reported cases has occurred on the left side at its anterior portion. The opening may be so small as to allow the passage of only a single coil of intestine, or so large that a considerable part of the abdominal contents find their way into the thoracic cavity. This causes displacement of the heart to the right, prevents the expansion of the left lung, and if it occur in intra-uterine life may prevent the development of the lung. In Gautier's case the left half of the diaphragm was deficient, and nearly all of the small intestine, the stomach, spleen, and pancreas were found in the left chest. The left lung was rudimentary.

If inflation of the lungs by the catheter or otherwise is attempted, a sense of resistance is experienced. A physical examination of the chest shows that movement is limited to one side, the apex beat is far to the right, and usually there is tympanitic resonance over the left side. If a large deficiency in the diaphragm exists, infants usually survive but a few hours; if a smaller one, life may be prolonged indefinitely. Northrup* has reported a case in a child who lived to the age of three years and presented very obscure physical signs. It died from intercurrent disease, the only local symptom being marked dyspnœa. In this case several loops of the ileum, the cæcum, and the vermiform appendix were found in the thoracic cavity.

SCLEREMA.

Sclerema is a condition characterized by hardening of the skin and subcutaneous tissues. It may occur in circumscribed areas or extend over nearly the entire body. It affects infants who are very feeble and usually terminates fatally. Although sclerema is chiefly seen in the first days of life, it is not limited to the newly born, but may occur at any time during the first few months. It is not to be confounded with œdema of the newly born, with which condition it is, however, sometimes associated. From published reports it appears to be of not very infrequent occurrence in Europe, chiefly in large foundling asylums. In America, sclerema is an extremely rare disease. In a discussion in the American Pædiatric Society, in 1889, following the report of a case by Northrup, scarcely a dozen cases could be recalled by the members present. I have seen but five cases. In the newly born, sclerema affects those who are premature or very feeble, sometimes those who are syphilitic. Later it may follow any condition leading to extreme exhaustion, especially the different forms of diarrhœal disease.

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* Archives of Pædiatrics, vol. ix, p. 130.

The first thing to attract attention is usually the induration of the skin. It is often seen first in the calves or the dorsum of the feet, sometimes first in the cheeks, but soon extends over the greater part of the body. It is especially marked in the cheeks, buttocks, thighs and back, and regions where adipose tissue is abundant. It may affect the body uniformly or in circumscribed areas. The skin may be smooth or it may appear somewhat lobulated. The colour is normal or slightly bluish, often tinged with yellow. The lips are blue, and the capillary circulation so feeble that after pressure upon the nails the blood returns slowly or not at all. The limbs are stiff and board-like. The skin is cold to the touch, and often the thermometer in the axilla will not rise above 90° F. In cases reported by Roger and Parrot, an axillary temperature of 71° F. was recorded. The general feeling of the body has been well likened by Northrup to that of a half-frozen cadaver. The tongue and the mucous membrane of the mouth are cold; no radial pulse can be felt; the respiration is slow, irregular, embarrassed, and at times the movements of the thorax are scarcely perceptible. The cry is a feeble whine, scarcely audible. The duration of the disease is usually from three to four days. Death occurs slowly and quietly. If recovery takes place there is gradual improvement in the circulation and nutrition, and, later, a disappearance of the areas of induration.

The causes of sclerema are general, not local, the most important etiological factors being great feeblenesss, with lowering of the body temperature, and, in consequence, hardening of the subcutaneous fat. If it be true, as stated by Langer, that the fat of childhood contains more palmitine and stearine than that of adults, it is easy to see how this may occur. There are no essential lesions in this disease. Atelectasis is often present, and may have something more than an accidental association, as incomplete aëration of the blood is no doubt a factor in the production of the symptoms. In Northrup's case, the skin after being injected was studied with great care microscopically, with absolutely negative results.

The prognosis is very bad, because of the grave conditions of which it is the expression, but it is not invariably fatal. In its milder forms, where treatment is begun early, recovery may take place. The diagnosis is to be made from œdema by the fact that there is no pitting upon pressure, by the rigidity of the body, and by the great reduction in the temperature. The most important thing in treatment is artificial heat; nothing but the incubator is efficient. In addition to this, care should be taken to promote the general nutrition by careful feeding and by all other means possible.

ŒDEMA.

Œdema has often been confounded with sclerema, but, although they may sometimes exist together, the conditions are quite distinct. Œdema occurs in delicate infants, and is associated with a feeble heart, especially of the right side, in consequence of which there are insufficient aëration of the blood, overfilling of the veins, and often a lowering of the body temperature. It also depends upon poor blood states, like severe anæmia, and I have seen it occur after hæmorrhages. The kidneys are unaffected.

The swelling is first noticed in the eyelids, the dorsum of the feet, the hands, or in dependent parts of the body. It may come on quite suddenly. In severe cases there may be general anasarca, but dropsy into the serous cavities is rare. Sometimes the first thing observed may be a sudden increase in weight before the œdema of any part is striking enough to be noticed. The general condition is feeble; the surface of the body cool; the temperature often subnormal; the cry weak; the urine often scanty, but rarely albuminous. The diagnosis of œdema is quite easy, the parts having the same appearance as in older patients. They are soft and waxy-looking, and pit upon pressure. While in most cases the prognosis is unfavourable, the disease is not necessarily fatal, since some even of the severe cases recover. The usual duration is five or six days; but there are frequently relapses.

The object of treatment is first to promote the general nutrition by all available means, and then to improve the circulation by the administration of heart stimulants, particularly digitalis and alcohol. In cases of extensive œdema, alkaline diuretics, like the citrate of potash, may be combined with digitalis. The body-temperature must be carefully maintained by artificial heat. The principal complications are diseases of the lungs and of the intestines.

INANITION FEVER.

The term *inanition fever* is not altogether a satisfactory one; but, until these cases are better understood, it is adopted because it emphasizes the very close connection which exists between the rise of temperature and the condition of inanition or starvation. Under this heading are included cases seen during the first five days of life—generally from the second to the fourth day—in which there is an elevation of temperature, apparently due to the fact that the infant gets very little, frequently nothing at all from the breast at which it is being suckled. It is further characteristic of these cases that the temperature falls when the milk is secreted in abundance, or when the child is put upon a full breast, or when artificial feeding is begun, or even when water is administered, if freely given.

So far as my knowledge goes, the first to call attention to this condition was McLane (New York), who in 1890 reported to one of the medical societies an extraordinary case of hyperpyrexia in a newly-born child. The infant was found on the sixth day with a temperature of 106° F., near which point it had remained for three days. The child was being suckled at a breast which was found to be absolutely dry. A wet-nurse was procured, the temperature fell to normal in a few hours, and the child, which when first seen was apparently in a hopeless condition, was soon perfectly well.

Since that time very extensive observations, extending to upward of three thousand cases, have been made at the Sloane Maternity and Nursery and Child's Hospitals, which have established the fact that a rise of temperature to 102° or even 104° F. is quite common in newly-born infants during the first few days. This fever is accompanied by no evidences of local disease, and ceases in nursing infants with the establishment of the free secretion of milk. The fall in temperature is often rapid, dropping to the normal in a few hours after having continued for three or four days, and in a large number of cases it does not rise again.

The following case is a fairly typical one of the more severe form: The patient was the second child, the first having died at the age of ten days, from no disease it was said, but simply from exhaustion. At birth the infant, a boy, weighed eight and a quarter pounds and was apparently vigorous. During the first forty-eight hours his loss in weight was five and a half ounces and his condition good. I saw him on the evening of the third day. In the preceding twenty-four hours he had lost eight ounces in weight, and the temperature had gradually risen, until at the time of my visit it was 102·8° F. The body was limp, the child making no resistance to examination. He cried with a feeble whine; the restlessness of the early part of the day having given place to complete apathy. The lips and skin were very dry, the fontanel sunken, the pulse weak. As the father, a physician, expressed it, "he had been wilting through the day like a flower in the sun." Although put to the breast regularly, the child had apparently got very little. It was, in fact, impossible to squeeze any milk from the mother's breasts. Water was freely given and a wet-nurse secured in a few hours. The first milk was taken from the wet-nurse at 11 P. M., and the temperature, which fell gradually during the night, was normal the next morning and did not rise again. (See chart, Fig. 21). During the succeeding four days the child gained eighteen ounces in weight, and at the end of a week was as well as an average infant of his age.

The symptoms are so uniform and so characteristic that they make for these cases of fever a class by themselves. The frequency with which this is seen is shown by the following statistics: Among 200 infants taken successively at the Nursery and Child's Hospital, 20 had fever during the first five days, reaching 101° F. or over, which was not explained by ordinary causes and followed the course above described. In 500 successive children born at the Sloane Maternity Hospital, there were 135 with a similar fever. It was seen in vigorous infants as well as in those who were delicate. The usual duration of the fever was three days, the temperature generally touching the highest point upon the third or fourth day of life. In about two thirds of the cases the temperature did not rise above 102° F.; in 9 it was 104° F. or over, the highest recorded being 106° F. The fall was generally quite abrupt, although not always so. Daily weighings, which were made in these cases, showed that the infants continued to lose weight while the fever continued, and that the loss almost invariably exceeded by several ounces that of the children who had no fever. (See p. 16.) The maximum loss noted was twenty-eight ounces. In quite a large number of cases it exceeded twenty ounces. As a rule the infants began to gain in weight when the temperature remained at the normal point, but not until then.

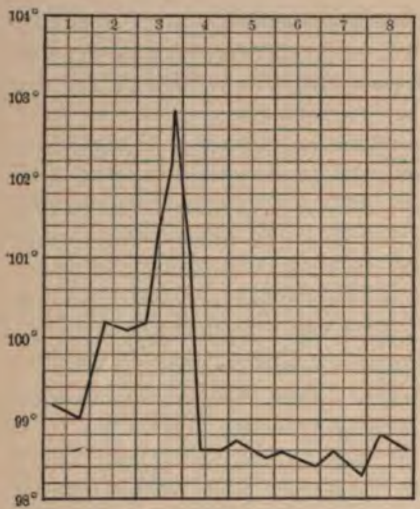

Fig. 21.—Temperature chart. Inanition fever.

The symptoms presented by these infants were a hot, dry skin, marked restlessness, dry lips, and a disposition to suck vigorously anything within reach. With very high temperature there were considerable prostration and weakened pulse. In the less severe cases there were only crying and restlessness. The rapidity with which the symptoms disappeared when the children were wet-nursed or properly fed, was very striking.

It is important that this fever should be recognised, because it gives at times the first warning of a condition which may prove fatal. The extra loss of ten or fifteen ounces in the first week, is a serious handicap to newly-born infants, the effect of which may last for several weeks. The temperature of every child should be taken during the first week. All the usual local causes of fever are first to be excluded by a physical examination. This fever can hardly be confounded with that due to pyogenic infection, which rarely begins before the fifth or sixth day.

The treatment is simple—viz., to give water regularly every two hours, in quantities up to an ounce at a time if required by the thirst of the child. This should be done in every case where the temperature reaches 101° F. When the temperature does not at once begin to fall, the infant should be put upon another breast or artificial feeding should be begun. Examination of the breasts from which the child has been nursing will usually reveal the fact that the secretion of milk is very scanty and often entirely absent.

Such a fever I have occasionally seen in older infants, usually in those who are nursing dry breasts or where fluid food and water have been withheld because of some gastric disturbance. It yields as promptly to treatment as does the same condition in the newly born.

SECTION II.

NUTRITION.

CHAPTER I.

INTRODUCTORY.

NUTRITION in its broadest sense is the most important branch of pædiatrics. At no time of life does prophylaxis give such results as in infancy, and no part of prophylaxis is worthy of more attention than the conditions of nutrition. This study is the first duty of physicians who practise among children. The importance of correct ideas regarding it can hardly be overestimated. The problem is not simply to save the child's life during the perilous first year, but to adopt those means which shall, during the plastic period of infancy, tend to the healthy and normal growth of the child, so that all the organs of the body shall have their normal development instead of impaired structure and deranged function, the effects of which may last throughout childhood or even throughout life.

The question whether a child shall be strong and robust or a weakling, is often decided by its food during the first three months. The largest part of the immense mortality of the first year is traceable directly to disorders of nutrition. The child must be fed so as to avoid not only the immediate dangers of acute indigestion, diarrhœa, and marasmus, but the more remote ones of chronic indigestion, rickets, scurvy, and general malnutrition with all its varied manifestations, since these conditions are the most important predisposing causes of acute disease in infancy.

One of the difficulties has always been that temporary success may mean ultimate failure. If the injurious effects of improper feeding were immediately manifest, there would be very much less of it than exists at the present time. It is because many things are valuable as temporary foods, which when used permanently are injurious. No better illustration is seen than in the too exclusive use of carbohydrates, like most of the proprietary foods. Infants so fed grow very fat, and for the time appear to be properly nourished. The absence from the food of some of those elements which are of vital importance may not be evident for months; hence the mistakes so often made by the laity, and even by the profession.

There are certain plain rules regarding the requirements of the growing organism which can not be ignored without serious consequences, which will sooner or later be evident. Another common mistake is in the prolonged use of predigested foods. These are sometimes continued until, as in a case under my observation, a healthy child at two-and-a-half years was totally unable to digest the casein of cow's milk. A great stumbling-block to many is the fact that there are some infants of robust constitution who, in good surroundings, have thriven exceptionally well in spite of very bad methods of feeding. But it should not be forgotten that there are a very much larger number of perfectly healthy infants whose lives are sacrificed every year, both directly and indirectly, as a result of improper feeding. A method of feeding is to be judged not by the few exceptional cases which may do well, but by the results obtained in the majority of cases.

Let no one think that he can secure the best results in infant-feeding without devoting both time and study to the problem. Close attention to details is indispensable to success in this as in all branches of medicine; but in none are more satisfactory results obtained.

THE FOOD CONSTITUENTS AND THE PURPOSES THEY SUBSERVE IN NUTRITION.

In infancy and childhood, as in adult life, the elements of the food are five in number: proteids, fat, carbohydrates, mineral salts, and water. The form in which they must be furnished to the child, and the relative quantities in which they are demanded, are different from those required by the adult. One of the reasons for this difference is the delicate condition of the organs of digestion in infancy, and the inability to assimilate certain forms of food. Another reason is that provision must be made not only for the natural waste of the body, but for its rapid growth, nearly trebling in size, as it does, during the first twelve months.

Proteids.—The proteids are essential to life, since they constitute the only kind of food which is capable of replacing the continuous nitrogenous waste of the cells of the body, upon the healthy condition of which the digestion and assimilation of the other elements of the food depend. Without the aid either of the fats or the carbohydrates, the proteids may sustain life and may even prevent a loss of weight for a time; but in so doing a great excess of such food is required, as twenty-two parts of proteids can do the work of only ten parts of fat. Such a diet taxes severely the digestive organs and the kidneys. When, however, fat and carbohydrates are added to the food, only one-half or one-third as much proteids are required to replace the nitrogenous waste, as in the case of an exclusive proteid diet (Munk).

The proteids are furnished by the casein and the other albuminoids present both in woman's milk and cow's milk, in the white of egg, muscle-fibre, gluten of wheat, etc. The proteids easiest of digestion by infants are those of woman's milk. The greatest difficulty in artificial feeding has been to supply other proteids which can take their place. It is the difference in the digestibility of the proteids that causes most of the trouble in the substitution of cow's milk for woman's milk.

The average amount of proteids furnished in a good sample of woman's milk is 1·5 per cent. During the first few months, infants fed upon cow's milk should not receive a larger proportion than this, and on account of the difference in the digestibility of the two, the proteids of cow's milk must at first be reduced below this point, usually to 1 per cent, and in some instances to 0·5 per cent. Some infants fed upon milk appear to thrive normally for a considerable period, even with so small a proportion of proteids as 0·5 per cent, provided the other elements of the food are supplied in abundance. But all children fed on low proteids must be very closely watched. It is always hazardous to keep an infant long upon a food which is low both in proteids and fat.

The most constant symptom following insufficient proteids in the food is anæmia. Besides this, there may be feeble circulation, loss of strength, flabbiness of the tissues, and general failure of nutrition. Later there may follow difficulty in the digestion of other elements of the food. The vegetable proteids can not permanently take the place of the animal proteids in the food of young infants.

Fats.—As has already been hinted on the previous page, the uses of fat in the body are intimately associated with those of the proteids. Fat possesses the important property of saving nitrogenous waste, so that when this is supplied in the food in proper proportions, the entire energy of the proteids may be expended upon the growth and nutrition of the cells of the body without being used up in the production of animal heat. The demands made upon the proteids by the rapid growth of the body in infancy, make it desirable that, whenever possible, the fats should do the work of the proteids.

In addition to their use as a source of animal heat, the fats add to the body-weight by storing up fat in the body. They are needed for the growth of the nerve cells and fibres, and are essential to the proper growth of bone. Exactly what the part is which the fats take in the development of the osseous system is not altogether understood, but it is probable that their effect is due to their well-known and important function in aiding the absorption from the intestines of inorganic salts, especially the earthy phosphates. In a patient upon a milk diet, when the fats are withheld or greatly reduced, these salts appear in large quantities in the fæces. More fat is supplied in the food of the nursing infant than is used up in the body, as a very large amount is normally discharged in the stools. To this is due the soft consistence of the stools of the nursing infant. Fats thus seem to fill the rôle of a natural laxative; constipation being one of the first and most striking symptoms following the reduction of fat in the milk.

The proportion of fat required in infancy, is therefore very much greater than at any other period of life. Probably the most common mistake in artificial feeding has been to give too little fat. The chief reason for the failure of most of the proprietary infant-foods is that they are too low in fat; but an excess of carbohydrates can not supply this deficiency.

Woman's milk of a good quality contains from 3 to 5 per cent fat, and this may be taken as representing the needs of the body under normal conditions. Infants who are fed upon cow's milk should get, on the average, 3 per cent fat for the first few months and 4 per cent during the latter part of the first year. Infants who are fed for a long time upon a food low in fat are very prone to develop rickets. Clinical experience also teaches that if the food at the same time is low in proteids this result follows much more readily. As such a diet is in most cases excessive in carbohydrates, children so fed are apt to be very fat, but usually anæmic. The importance of fats in nutrition does not end with the first year; they should be supplied liberally throughout childhood. The most convenient form of administration is cream, and next to this cod-liver oil.

Carbohydrates.—Although these, like the fats, can not replace the nitrogenous waste of the body, they are important aids to the proteids, and in this respect they are even more valuable than the fats. The carbohydrates are partly converted into fat, and may thus increase the body-weight. They are capable of replacing the fat-waste of the body. They are one of the most important sources of animal heat.

Carbohydrates are the most abundant of the solid elements of the food, although they form a smaller percentage of the entire quantity of food in infancy than in adult life. The form in which carbohydrates are furnished to the infant, and in fact to all young mammals, is milk-sugar. While this form of sugar is to be preferred, it is by no means so essential that it be given as that the fat and proteids of the food should be those of milk. Other forms of sugar may often take its place without interfering with nutrition. Sometimes, when there is difficulty in the digestion of milk-sugar, a temporary change to cane-sugar or to maltose may even be advantageous. The carbohydrates required by young infants can not, except to a very small extent, be supplied in the form of starch, owing to the feeble diastatic power of the digestive fluids during the early months, and in fact during the greater part of the first year. As a rule, there is less difficulty in the digestion of the carbohydrates in the form of sugar than of any other part of the food. A diet consisting too exclusively of carbohydrates leads often to a rapid increase in weight, but it is not accompanied by a proportionate increase in strength. Such infants have but little resistance, and many of them become rachitic. The easy digestion of a food consisting chiefly of soluble carbohydrates, and the rapidity with which children so fed gain in weight, lead to a great misapprehension in regard to their value as foods. The ultimate results of such one-sided feeding, if long continued, are almost invariably disastrous.

In building up the cells of the body the proteids are first in importance, the carbohydrates second, and the fats third. In the production of animal heat the fats come first, the carbohydrates second; practically the proteids should never be called upon for this purpose. In a proper diet, all of these elements are represented.

Mineral Salts.—These are of greater importance in infancy than later in life, because of the building up of the osseous system which is going on with such rapidity during infancy and early childhood. The most important for this purpose are the phosphates of lime and magnesium. These are furnished in abundance both in woman's and cow's milk. These salts are also necessary for cell growth. Other inorganic salts furnish the elements from which the mineral constituents of the blood and digestive fluids are formed, and still others facilitate absorption, excretion, and secretion.

Water.—The food of all young mammals consists of from eighty to ninety per cent of water. This is needed for the solution of certain parts of the food, such as the sugar and some of the proteids, and for the suspension of the other proteids and the emulsified fat. All the food is thus dissolved or very finely divided so as to be more readily acted upon by the feeble digestive organs of the infant. Water is needed also in large quantities for the rapid elimination of the waste of the body. In proportion to its weight, an average infant during the first year requires a little more than six times as much water as an adult. During the time when the child is upon an entirely fluid diet, the addition of water other than that supplied by the food is unnecessary; but when the number of feedings becomes less frequent, and solid food is given in larger quantities, water should be given freely between the feedings at all seasons, but especially in the summer.

CHAPTER II.

THE INFANT'S DIETARY.

WOMAN'S MILK.

WOMAN'S milk is the ideal infant-food. A thorough knowledge of its character, exact composition, and variations is indispensable, for upon this knowledge are based all our rules for the preparation of foods used as substitutes for woman's milk when this can not be obtained.

Woman's milk is a secretion of the mammary glands and not a mere transudation from the blood-vessels; although under abnormal conditions it may partake more of the character of a transudation than a secretion. A few drops may be squeezed from the breasts before parturition; generally speaking, however, it is only present after delivery. During the first two days the secretion is scanty. Usually upon the third or fourth day it becomes well established, although it may be delayed until the fifth or sixth day. During the period of lactation, milk is constantly formed in the mammary glands, but the process is more active while the child is at the breast.

Physical Characters.—Woman's milk is of a bluish-white colour and quite sweet to the taste. When freshly drawn its reaction is usually alkaline, sometimes neutral, but under healthy conditions never acid. The specific gravity varies between 1,027 and 1,032, the average being 1,031 at 60° F. On the addition of acetic acid only a slight coagulation is seen, this being in the form of small flocculi, and never in large masses as is the case in cow's milk. Microscopically, there are seen great numbers of fat-globules nearly uniform in size and some granular matter. Occasionally there are present epithelial cells from the milk-ducts or from the nipple.

Colostrum.—The secretion of the first two or three days differs quite markedly from the later milk. To this the name *colostrum* has been given. It is of a deep yellow colour, which is chiefly due to the colostrum-corpuscles. It is not so sweet as the later milk. It has a specific gravity of 1,040 to 1,046, a strongly alkaline reaction, and is coagulated into solid masses by heat, and sometimes coagulates spontaneously. It is very rich in proteids and in salts. Microscopically the fat-globules are of unequal size, and there are present large numbers of granular bodies known as colostrum-corpuscles (Fig. 22). These are four or five times the size of

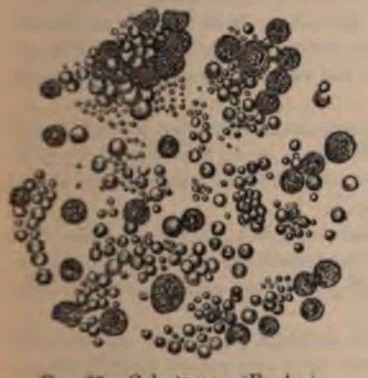

FIG. 22.—Colostrum. (Funke.)

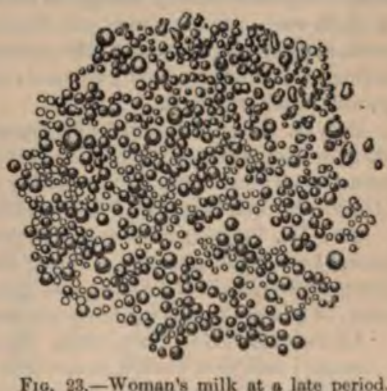

FIG. 23.—Woman's milk at a late period. (Funke.)

the milk-globules (Fig. 23), and they are probably epithelial cells which have undergone fatty degeneration.

*Composition of Colostrum.**

Proteids	5·71
Fat	2·04
Sugar	3·74
Salts	0·28
Water	88·23
	100·00

The colostrum-corpuscles are very abundant during the first few days, but under normal conditions they are not found after the tenth or twelfth day.

Daily Quantity.—Exact information upon this point is difficult to obtain. There are recorded, however, extended observations made with great care upon five cases,† from which some deductions may safely be drawn. All were healthy infants, nursing exclusively and gaining steadily in weight.

From these observations, and others less extended, the average daily

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* From five analyses by Pfeiffer of milk obtained during the first three days.

† Haehner's cases (Jahrb. f. Kinderh., xv, 23; xxi, 314). Case I. Female; birth-weight 7 pounds 14 ounces (3,100 grammes). First week, lost 1½ ounce (41 grammes); after this gained steadily during the twenty-three weeks of observation; from second to ninth week, average weekly gain 8 ounces (241 grammes); from tenth to eighteenth week, average gain 4½ ounces (138 grammes); from nineteenth to twenty-third week, average gain 4 ounces (130 grammes); weight at the end of twenty-third week, 14¾ pounds (6,690 grammes).

Case II. Male; birth-weight 6½ pounds (2,950 grammes). Loss, first week, 3 ounces (80 grammes); after this gained steadily during the eleven weeks of observation; from second to eleventh week, average weekly gain 7½ ounces (214 grammes); weight at end of eleventh week, 11 pounds 2 ounces (5,045 grammes).

Case III. Female; birth-weight 3 pounds 9 ounces (1,620 grammes). Gain, first week, 1½ ounce (40 grammes); during the succeeding twenty-one weeks of observation, average weekly gain of 5 ounces (141 grammes); weight at the end of twenty-second week, 10 pounds 3 ounces (4,620 grammes).

Laure's case (Thèse, Paris, 1889). Female; birth-weight 8 pounds 13 ounces (4,000 grammes); loss, first week, 8 ounces (225 grammes); after this gained steadily during the nine weeks of observation, on an average 9½ ounces (268 grammes) weekly; at the end of ninth week, weight 13 pounds 3½ ounces (6,000 grammes).

Ahlfeld's case (Deutsch. Ztschr. f. Prakt. Med., 1878). Birth-weight 7 pounds 14 ounces (3,100 grammes). Observations continued from fourth to thirtieth week. During first ten weeks, average weekly gain 5¾ ounces (161 grammes); from eleventh to twentieth week, 7½ ounces (214 grammes); from twenty-first to thirtieth week, 6 ounces (168 grammes); at the end of thirtieth week, weight 18 pounds 9½ ounces (8,435 grammes).

In all these cases the amount of milk was determined by weighing the infant upon quantity of milk secreted under normal conditions of health may be assumed to be pretty nearly as follows:

	Approximately.
At the end of the first week	10 to 16 oz. (300 to 500 grm.).
During the second week	13 to 18 oz. (400 to 550 grm.).
During the third week	14 to 24 oz. (430 to 720 grm.).
During the fourth week	16 to 26 oz. (500 to 800 grm.).
From the fifth to the thirteenth week	20 to 34 oz. (600 to 1,030 grm.).
From the fourth to the sixth month	24 to 38 oz. (720 to 1,150 grm.).
From the sixth to the ninth month	30 to 40 oz. (900 to 1,220 grm.).

It will be noted that the amount increases very rapidly up to about the eighth week, and after this much more slowly. The amount of milk varies also with the demands of the child in a very striking and uniform way.

A comparison of the daily amount of milk taken with the weight of the child at the different periods, shows that during the first ten weeks large children take on an average an amount equal to from fifteen to nineteen per cent of the body-weight; while smaller children, during the same period, take only from twelve to fourteen per cent of the body-weight. From the eleventh to the thirteenth week the large children take daily from thirteen to seventeen per cent of the body-weight, and the small ones from eleven to thirteen per cent, showing that the larger

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very delicate scales both before and after every nursing during the entire period of observation.

The following table gives in a condensed form the daily quantity of milk in these cases:

TIME.	Haehner's 1st case.	Haehner's 2d case.	Haehner's 3d case.	Laure's case.	Ahlfeld's case.
	Grammes.	Grammes.	Grammes.	Grammes.	Grammes.
1st day	20	75	20	...	...
2d day	176	135	45	...	...
3d day	265	325	70	125	...
4th day	420	295	99	222	...
5th day	360	290	124	400	...
6th day	374	340	136	475	...
7th day	423	350	156	500	...
Average 2d week	497	423	229	556	...
Average 3d week	550	468	314	730	...
Average 4th week	594	531	379	810	576
Average 5th week	663	561	447	944	655
Average 6th week	740	661	472	978	791
Average 7th week	880	681	525	1,038	811
Average 8th week	835	730	568	1.024	845
Average 9th week	766	665	584	1,085	810
Average 10th to 13th week	796	...	600	....	869
Average 14th to 17th week	807	...	673	....	983
Average 18th to 23d week	870	...	709	....	1,029
Average 24th to 30th week	...	...	...	....	1,145

children take not only more food, but more in proportion to their size than the smaller ones.

The average quantity taken at one nursing by the five children previously mentioned was as follows:

		Approximately.
During the first week	⅝ to 1½ oz.	(18 to 50 grm.).
During the second week	1 to 3 oz.	(30 to 90 grm.).
During the third week	1½ to 4 oz.	(45 to 120 grm.).
During the fourth week	1½ to 4½ oz.	(45 to 140 grm.).
From the fifth to the seventh week	2 to 5 oz.	(64 to 150 grm.).
From the eighth to the eleventh week	2½ to 5½ oz.	(75 to 160 grm.).
During the fourth month	3 to 6 oz.	(90 to 180 grm.).
During the fifth month	3½ to 6½ oz.	(110 to 200 grm.).
During the sixth month	4 to 7 oz.	(120 to 220 grm.).

Between the limits mentioned the greater number of cases will undoubtedly fall. The amount taken at one time is, however, modified by the frequency of nursing, and is therefore not so good a guide to the amount of food required, as is the quantity taken in twenty-four hours.

Composition.—Many of the older analyses of milk gave erroneous results because of imperfect methods of examination. According to the most recent analyses of Pfeiffer, Koenig, Leeds, Harrington, and others, the composition of human milk is as follows:

	Average.	Common healthy variations.
	Per cent.	Per cent.
Fat	4·00	3·00 to 5·00
Sugar	7·00	6·00 " 7·00
Proteids	1·50	1·00 " 2·25
Salts	0·20	0·18 " 0·25
Water	87·30	89·82 " 85·50
	100·00	100·00 100·00

In the older analyses, the percentage of proteids is almost invariably too high and the sugar too low.

There are certain variations in composition depending upon the age of the milk. Nearly all these changes take place during the first month, and principally during the first two weeks. During this period there is, according to Pfeiffer, a fall in the proteids from nearly 4 to below 2 per cent, in the salts from 0·45 to 0·20 per cent, a rise in the sugar from 2 to 6 per cent, and a very slight increase in the fat. After the first month the regular variations in composition are so slight that they may be practically ignored.

Proteids.—The proteids are not yet fully understood. Their separation is somewhat difficult, and they are usually considered together. The most abundant and the most important ones are casein and lactalbumin, although Hammarsten gives a third—lactoglobulin—and some other authors even a fourth. The casein is not in solution but in suspension, by virtue of the presence in the milk of lime phosphate, with which it is probably in combination. The lactalbumin is in solution; it resembles serum-albumin. It is present in a larger proportion than in other varieties of milk. According to Koenig, lactalbumin is twice as abundant as casein.

The proteids are usually present in the proportion of 1 to 2 per cent in woman's milk, although the variations are quite wide (0·7 to 4·5 per cent). The amount of proteids is larger in the milk of the first few days. After the third week the proportion changes but little until near the end of lactation, when it falls very markedly.

Fat.—This exists in the form of minute globules, which are held in a state of permanent emulsion by the albuminous solution in which they are suspended. The old view, that the globules had an investing membrane, is now generally discarded. Like the proteids, the proportion of fat is subject to wide variations—4 per cent being taken as the average. In thirty-four analyses made for me at the laboratory of the College of Physicians and Surgeons, the fat varied between 1·12 and 6·66 per cent. In forty-three analyses by Leeds, the variations were between 2·11 and 6·89 per cent. The proportion is very little affected by the period of lactation.

Sugar.—The sugar is in complete solution. Its proportion is very constant, the average being seven per cent. The ordinary variations are usually within the limits of 6 and 7 per cent. The sugar being so important as a heat-producing element, Nature has wisely provided that this shall be the most constant ingredient of the milk. The amount of sugar is smallest in the milk of the first week; after the first month, however, the variations are slight.

Salts.—The average proportion of inorganic salts is 0·20 per cent, or about one fourth that of cow's milk. According to Rotch's analysis, the inorganic salts exist in the following proportions:

Salts in Woman's Milk.

Calcium phosphate	23·87
Calcium silicate	1·27
Calcium sulphate	2·25
Calcium carbonate	2·85
Magnesium carbonate	3·77
Potassium carbonate	23·47
Potassium sulphate	8·33
Potassium chloride	12·05
Sodium chloride	21·77
Iron oxide and alumina	0·37
	100·00

With the exception of calcium phosphate nearly all the salts are in solution. The milk of the first few days is very rich in salts—the proportion being fully twice that of any later period. After the first month the variations are slight.

The Examination of Milk.—The exact composition of human milk is to be determined only by a complete chemical analysis. There are, however, many variations which the physician may readily ascertain for himself by simple methods of examination.

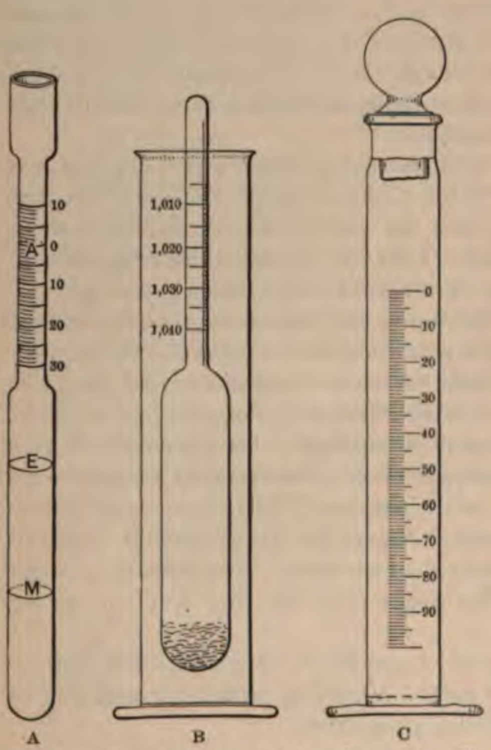

Fig. 24.—Apparatus for examination of woman's milk. A, Marchand's tube; B, C, the author's lactometer and cream-gauge.

The *quantity* of milk secreted by the breasts may be estimated by the quantity which may be drawn by a breast-pump, although this is not a very reliable test. If the child nurses habitually forty or fifty minutes, the probabilities are very strong that the quantity of milk is small. If the breasts at nursing time are full, hard, and tense, the supply is probably abundant. If they are soft and flabby, and the milk appears to run in only while the child is nursing, it is almost certain that the quantity is small. The most reliable of all tests is weighing the infant before and after nursing, upon an accurate pair of scales, sufficiently sensitive to indicate half-ounces. Two or three weighings will suffice to show conclusively whether an infant at three months, for instance, is getting habitually four or five, or only one or two ounces at a nursing.

The *reaction* of milk may be taken with ordinary litmus paper. When freshly drawn it should be alkaline or neutral, never acid.

The *specific gravity* may be taken with any small hydrometer graduated from 1,010 to 1,040 (Fig. 24, B). The specific gravity is lowered by the fat, but increased by the other solids. An ordinary urinometer will answer every purpose, the only difficulty being the quantity which is required to float the instrument.

Microscopical examination.—The microscope reveals the presence of colostrum-corpuscles, blood, pus, epithelium, and granular matter. Colostrum-corpuscles are abnormal after the twelfth day; pus and blood are always abnormal. All of these conditions necessitate the suspension of nursing, at least temporarily. But little importance can be attached to the size and appearance of the fat-globules as affecting the nutritive properties of the milk.

The determination of fat.—The simplest method is by the cream-gauge (Fig. 24, C), which is sufficiently accurate for ordinary clinical purposes. The glass cylinder holding ten cubic centimetres is filled to the zero mark with freshly drawn milk. This is allowed to stand at the temperature of the room (66° to 72° F.) for twenty-four hours, and the percentage of cream is then read off. Under these conditions, the relation of the percentage of cream to that of fat is very nearly as five to three; thus five per cent of cream will indicate that the milk contains three per cent of fat, etc. When an immediate determination of fat is desired, the most accurate instrument is the Babcock centrifugal machine. (See page 140.) Marchand's tube (Fig. 24, A) may also be employed. In this test the fat is extracted by ether and then precipitated by alcohol.* The various optical tests which have been suggested are much less satisfactory.

Sugar.—The proportion of sugar is so nearly constant that it may be ignored in clinical examinations.

Proteids.—We have no direct method for determining clinically the amount of proteids. If we regard the sugar and salts as practically uniform, or so nearly so as not to affect the specific gravity, we may form an approximate idea of the proteids from a knowledge of the specific gravity and the percentage of fat. We may thus determine pretty positively whether they are greatly in excess or very scanty. The specific gravity will then vary directly with the proportion of proteids, and inversely with the proportion of fat—i. e., high proteids, high specific gravity; high fat,

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* Marchand's test: First put in five cubic centimetres of milk, up to the line M; then four or five drops of liquor sodæ; shake; add five cubic centimetres of ether, up to the line E; cork, and shake fifteen or twenty times; add ninety-per-cent alcohol, up to the line A. The tube is now tightly corked, shaken thoroughly, and placed upright in a tall bottle containing water at a temperature of 120° to 150° F. The fat separates and forms a distinct layer at the top, and after half an hour the amount is read off in degrees. By reference to the following table the exact percentage of fat is shown:

Degrees Marchand.	Percentage of fat.	Degrees Marchand.	Percentage of fat.
1	1·49	13	4·29
3	1·96	15	4·75
5	2·42	17	5·22
7	2·89	19	5·68
9	3·36	21	6·14
11	3·82		

Each additional degree on the tube corresponds to 0·23 per cent of fat. To insure accuracy the test should be repeated two or three times with the same specimen.

These tubes may be obtained from E. Greiner, 51 William Street, New York.

low specific gravity. The application of this principle will be seen by reference to the accompanying table.*

Woman's Milk.

	Specific gravity 70° F.	Cream—24 hours.	Proteids (calculated).
Average............	1·031	7%	1·5%
Normal variations...	1·028 — 1·029	8% — 12%	Normal (rich milk).
Normal variations...	1·032	5% — 6%	Normal (fair milk).
Abnormal variations.	Low (below 1·028).	High (above 10%).	Normal or slightly below.
Abnormal variations.	Low (below 1·028).	Low (below 5%).	Very low (very poor milk).
Abnormal variations.	High (above 1·032).	High.	Very high (very rich milk).
Abnormal variations.	High (above 1·032).	Low.	Normal (or nearly so).

The specimen taken for examination should be either the middle portion of the milk—i. e., after nursing two or three minutes—or, better, the entire quantity from one breast, since the composition of the milk will differ very much according to the time when it is drawn. The first milk is slightly richer in proteids and much poorer in fat. The last drawn from the breasts is low in proteids and high in fat. The following analyses from Forster illustrate these differences:

	First portion.	Second portion.	Third portion.
	Per cent.	Per cent.	Per cent.
Fat.....................	1·71	2·77	5·51
Proteids................	1·13	0·94	0·71

Conditions Affecting the Composition of Woman's Milk.—*The age of the nurse.*—This has no constant influence. Other things being equal, the milk of very young women, and also of those over thirty-five years of age, is likely to be lower in fat than that of women between twenty and thirty-five years.

Number of pregnancies.—This has no constant influence except such as results from the effect upon the general health of the nurse.

Acute illness.—In the majority of cases of acute illness of a minor character and of short duration there is no perceptible effect upon the milk. In the acute febrile diseases of a severe type the quantity of milk is reduced, the fat is low, and the proteids are apt to be high. In septic conditions bacteria may appear in the milk.

Menstruation.—The effect of this is exceedingly variable, depending much upon the individual and the ease of menstruation. From observations upon 685 cases, Meyer noted disturbances in the child in over one half the number. My own experience accords rather with that of

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* The author's apparatus for this examination, consisting of lactometer (Fig. 24, B) and two cylindrical graduated glasses (Fig. 24, C), may be obtained from Eimer and Amend, Eighteenth Street and Third Avenue, New York. With these the test can be made with half an ounce of milk. For a fuller discussion of the subject, see article by the author in Archives of Pædiatrics, March, 1893.

Pfeiffer and Schlichter, who consider it quite exceptional for the child to be visibly affected. Schlichter made observations upon infants during 233 menstrual days, noting the condition of the stools and digestion both before and after menstruation. In ninety per cent of the cases there was no perceptible influence. In only eight per cent were the stools bad, and in only three per cent was there disturbance of the stomach with vomiting.

The nature of the changes in milk produced by menstruation is illustrated by the following case taken from Rotch:

	Second day of menstruation. Bowels of child loose.	Seven days after menstruation. Bowels regular.	Forty days after menstruation. Child gaining rapidly.
	Per cent.	Per cent.	Per cent.
Fat	1·37	2·02	2·74
Sugar	6·10	6·55	6·35
Proteids	2·78	2·12	0·98
Salts	0·15	0·15	0·14
Water	89·60	89·16	89·79

At the present time sufficient observations have not been made to show whether the differences noted in the above case—low fat and high proteids—are the rule where disturbances are produced during menstruation. Monti's examinations lead him to the conclusion that the fat is not constantly affected. It is safe to say that the changes are not uniform, and that in very many cases none of importance are produced by menstruation.

Diet.—The fat and the proteids of the milk are much influenced by diet, the sugar but very little. A nitrogenous diet increases quite uniformly both the fat and the proteids. A vegetable diet diminishes both the fat and the proteids. A starvation diet diminishes the fat, while the proteids may be diminished or increased; if the latter, they are generally changed in character. An excessively rich diet increases the fat and usually the proteids also. All fluids tend to increase the quantity of milk. Alcohol in the form of malted drinks, and malt-extracts increase the quantity of milk and the amount of fat. The effect of alcohol upon the proteids is not constant, but they are usually increased. The following table gives the result of analyses of the milk of two women in the New York Infant Asylum before, while taking, and after taking an alcoholic extract of malt:

	I. Without malt.	II. After taking 8 oz. malt daily for 10 days.	III. No malt for 7 days.
Case I:	Per cent.	Per cent.	Per cent.
Fat	1·74	3·83	2·41
Proteids	1·93	1·58	2·95
Sugar	7·02	7·43	6·59
Salts	0·20	0·17	0·19
Case II:			
Fat	1·12	2·75	1·70
Proteids	1·57	2·34	1·26
Sugar	7·11	6·77	6·04
Salts	0·19	0·17	0·18

The child of Case I gained one ounce and a half during the four days preceding the first analysis; that of Case II did not gain at all. During the ten days while taking the malt, the first child gained twelve ounces, the second child eight ounces. During the seven days after the malt was discontinued, the first child gained eight ounces, the second child one ounce. There was a notable increase in the quantity of milk in both cases while taking the malt.

Klingemann has shown that the taking of alcohol of a poor quality (especially amylic alcohol) may cause it to appear in the milk, and may produce symptoms in the nursing infant, particularly if the amount taken is large. Seibert has called attention to very grave symptoms in infants produced by the ingestion of stale beer by nurses.

The nursing woman should have a generous diet of simple food, and should drink largely of milk or gruels made with milk. The diet should be a varied one, not excessive in nitrogenous food nor in vegetables. All salads and highly seasoned dishes should be avoided, not so much because they upset the child, although this may happen, as because they are likely to disturb the digestion of the nurse. All the common vegetables and fruits in season may be allowed in moderation. Strong tea and coffee should be prohibited, although weak tea or coffee may be allowed, each but once a day. Cocoa is less objectionable than either tea or coffee. In addition to her regular meals the nurse should have milk or gruel at bedtime. The diet should in all cases be adapted to her digestion. Great harm often results from over-feeding with its consequent indigestion. The taking of alcohol should be discouraged and its routine use forbidden.

Drugs.—The elimination of drugs through the milk is somewhat uncertain and variable. A large proportion of those popularly supposed to influence the child when taken by the nurse, have no effect whatever. The effect of drugs is more noticeable when the milk is very poor in quality; it being at such times more of an excretion than a secretion. This is seen during the early colostrum period, also during the illness of the nurse or when from various causes, mental or physical, the secretion becomes disturbed. The more important drugs affecting the child through the milk are the following:

Belladonna: Effect quite constant under all circumstances when given in full doses.

Opium: Effect inconstant, although it is possible, when the milk is poor, for toxic symptoms to be produced when full doses are given to the mother. A fatal case is on record in a child a few days old.

Potassium iodide: Effect not uniform, particularly seen when the administration is long continued. Koplik and others have reported the production of iodism in nursing infants while the drug was taken by the mother.

Bromides: Effect similar to that of the iodides.

Mercury: Effect very feeble, and only after prolonged administration.*

Drugs occasionally eliminated in milk in sufficient amount to produce visible effects are the saline cathartics, arsenic, and the salicylates. Acids, chloral, and most other drugs are without effect.

Pregnancy.—The milk of pregnant women is generally small in quantity and poor in quality, especially in fat. (See chart, p. 168.) It is not known, however, that there are any other differences.

Bacteria.—Under normal conditions human milk is practically sterile. In disease of the mammary gland of a suppurative character, bacteria are frequently found in the milk. They may also appear in considerable numbers during puerperal sepsis. In the milk of women suffering from acute fevers not of septic origin, Escherich found no bacteria. It has been shown that the bacilli of anthrax and tuberculosis may appear in cow's milk apart from any disease of the udder itself. This may fairly be assumed to be true in the case of human milk.

Nervous impressions.—These, when of a marked character, have a very decided and immediate effect upon the milk. Fatigue, exhaustion, great excitement, sudden fright, grief, or passion are likely to affect the secretion in a most marked manner. An infant who takes the breast under such circumstances may exhibit only the ordinary signs of acute indigestion, such as vomiting and undigested stools, or there may be in addition high temperature, great prostration, toxic symptoms, and sometimes even convulsions. The nature of the changes in milk from such causes is as yet but little understood. The probability is, however, that it is the proteids which are at fault, as these are very unstable and easily affected, and that instead of the normal proteids others are produced which possess toxic properties. In certain cases the secretion of milk may be almost entirely arrested by nervous influences.

COW'S MILK.

The only one of the lower animals whose milk is practically available for infant-feeding is the cow. Cow's milk being our main reliance in the artificial feeding of infants and the staple food of nearly all young children, it follows that everything relating to its production and handling is of great importance to the physician. In the feeding of children no one thing is more essential than a supply of pure cow's milk. Milk undergoes changes from such slight causes, that the physician should insist upon it that those who furnish milk for infant-feeding, whether in city or country, should be fully informed regarding this subject. In towns and cities physicians should co-operate to secure it for their patients in its best form.* The conditions to be fulfilled in good cow's milk are:

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* See Fehling, Arch. für Gynak., Bd. xxvii, H. 3.

1. It must be fresh. There are certain changes which take place in cow's milk, even when handled in the best manner, during the twenty-four or seventy-two hours which often elapse between the time it is drawn from the cows and its consumption. These changes, although perhaps not actually causing disease, may still interfere with the digestibility of milk, particularly for very young infants. It is entirely practicable in every city and town for milk to be obtained for young infants before it is twelve hours old, and this should be insisted upon.

2. It must be from healthy animals. All herds furnishing milk for infant-feeding should receive the tuberculin test; they should be subjected to careful and regular medical inspection.

3. Preferably it should be the milk from a mixed herd rather than from a single cow. A milk is thus secured which is practically uniform in its composition, while that from a single cow may be subject to a considerable variation from day to day. A child fed upon the milk of a single cow is not infrequently made ill from changes in the milk, the result of food, temporary indisposition or other disturbance of the animal.† If the milk is the mixed product of several cows such a result is very much less likely to occur.

4. The milk must be clean. This is only to be accomplished by a dissemination of knowledge among dairymen in regard to the common sources of milk contamination. It is to be secured by more rigid cleanliness in the stables, in the animals themselves, in the hands of the milker, in pails, cans, bottles, and all utensils with which the milk comes in contact. The amount of filth—dirt, hair, etc.—which is removed from ordi-

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* As an illustration of what can be accomplished in the way of securing a proper milk supply for the use of infants, the work of the Medical Commission of Newark, N. J., may be cited. This commission, organized largely through the efforts of Dr. H. L. Coit, has entered into an agreement with a dairyman, the terms of which are that the selection of the cows, the details regarding their food and care, and the handling of the milk shall be under the supervision of the Medical Commission. All these matters are carried out according to the most improved methods. The animals are subjected to a regular inspection by a competent veterinary surgeon; a chemist and bacteriologist are employed to see that the milk is kept up to the standard both as regards composition and purity. In return, the milk, which is delivered only in bottles, is stamped with the approval of the commission as "certified milk," and is sold at a slightly higher price than ordinary milk. Although in operation now but a short time, this plan has proved eminently successful both from a medical and commercial standpoint. If in every city and large town physicians would co-operate in this or some similar way, great good would be accomplished.

† It is well known that the milk of a cow during the "bulling" period may be the cause of very severe attacks of indigestion in infants who get such milk as their principal or only food. Such milk apparently contains some toxic products.

nary milk by passing it through a separator is simply appalling, and shows how carelessly most of our milk is handled at the present time. Bacterial contamination will be considered later.

5. The animals should have fresh food, and not brewer's grains, which they are so likely to have in the neighbourhood of large cities.

6. Transportation should be as short as possible, in order to secure freshness and to diminish the liability to the other changes which occur when milk is carried long distances.* The milk should be cooled, then bottled and sealed at the dairy, and kept at a temperature at or below 45° F., until it reaches the consumer. In this way all chances of contamination by handling after the milk leaves the dairy are avoided.

Composition.—The following table † gives the composition of milk from different breeds of cows:

	Durham.	Ayrshire.	Holstein.	Jersey.	American grades.	Common natives.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fat	4·04	3·89	2·88	5·21	4·01	3·69
Sugar	4·34	4·41	4·33	4·52	4·36	4·35
Proteids	4·17	4·01	3·99	3·99	4·06	4·09
Salts	0·73	0·73	0·74	0·71	0·74	0·73
Water	86·72	86·96	88·06	85·57	86·83	84·14

It will be seen that the averages are remarkably uniform in all the constituents except the fat, the variations here being between 2·88 and 5·21 per cent. Leaving out the Jerseys, the following represents very closely the average composition of cow's milk, as the physician has to do with it in infant-feeding:

Average Cow's Milk.

	Per cent.
Fat	3·50
Sugar	4·30
Proteids	4·00
Salts	0·70
Water	87·00
	100·00

As to the relative advantages of the different breeds for infant-feeding, the difference has not seemed to me to be very great, provided all are equally healthy. It should be remembered that tuberculosis is rather more common in Jerseys than in other breeds. Practically it is necessary that the physician should know only the amount of fat in the milk he is using, as this is the variable factor.

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* Very much of the milk consumed in New York has been transported one hundred miles, and some is even brought three hundred miles.

† These figures are compiled from over one hundred and forty thousand analyses, and have been collected by Mr. Gordon, of the Walker-Gordon Milk Laboratory; sixty thousand of these analyses refer to the American grades and the common natives.

The Examination of Cow's Milk.—For clinical purposes the reaction, specific gravity, and percentage of fat should be determined. The normal reaction of cow's milk is neutral or slightly acid; it should never be strongly acid. If it is strongly alkaline it is pretty certain that something has been added to it. The specific gravity is from 1,028 to 1,033. If the milk has been falsified by the removal of cream, the specific gravity is raised. The best of all ready methods of determining fat is the Babcock centrifugal machine.* By this the fat is brought to the surface by the centrifugal process after destroying the nitrogenous matter by sulphuric acid. This test is very accurate and can be made in five minutes. For institutions such an apparatus is indispensable; several specimens can be examined at the same time, and the composition of the milk and cream used can be determined each day. The optical test by means of Feser's lactoscope (Fig. 25) is a good one, and with a little experience in the use of the instrument is quite accurate.†

The cream-gauge (Fig. 24, C) may be used as for woman's milk, but it is not very accurate. The milk while warm from the cow should be put into the cylinder and cooled rapidly by being placed in ice water. Under these conditions, if the reading is made at the end of eight or ten hours the percentage of cream to that of fat is about four to one. If the milk has been first cooled and afterward handled two or three times before the test is made, the cream rises much less regularly and the above ratio is not maintained.

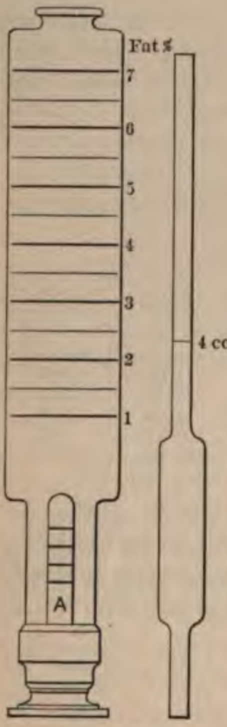

FIG. 25.—Feser's lactoscope.

The Differences between Cow's Milk and Woman's Milk.—The colour of cow's milk is more opaque than woman's milk, although the latter may contain the larger proportion of fat. This is due to the fact that the colour of the milk depends not only upon the fat but also upon the calcium phosphate with which the casein is combined. This is so much more abundant in cow's milk than in woman's milk that even after the fat has been removed from the former, it is still of a deep white colour, while woman's milk under the same conditions is almost transparent. The total solids are usually greater in cow's milk, but the difference is slight. The sugar, as in woman's milk, is lactose in complete solution. At the present time there are not known to be any important differences in the fat.

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* This can be obtained of any dairy-supply house in the country.

† The test is applied as follows: Four cubic centimetres of milk measured in a pipette is put into the tube and water slowly added, shaking from time to time until the black lines on the porcelain stem "A" are faintly visible through the milky water. The percentage of fat is then read off on the glass cylinder at the level of the water added. Thus, water up to the mark "4" indicates four per cent fat, etc. This test is not to be applied to human milk. For cow's milk it is pretty satisfactory if the instrument is carefully made. A little experience is necessary in order to know exactly at what point of translucency the reading is to be taken. The lactoscope may be obtained from Eimer & Amend, Eighteenth Street and Third Avenue, New York.

The most striking variation is seen in the proteids. Not only are the proteid substances in cow's milk from two to three times as great in amount, but they differ also in their character. The amount of proteid substances in cow's milk coagulable by acid is about four times as great as the non-coagulable portion; while in woman's milk the non-coagulable portion is twice as great as the coagulable portion (Leeds). This is due to the fact that in cow's milk there is much more casein than lactalbumin, while in woman's milk there is less. This variation is shown most strikingly by the physiological test—its digestibility by the infant's stomach. Cow's milk in the stomach is coagulated into larger, firmer clots which dissolve slowly; woman's milk into loose, flocculent curds, which dissolve readily.

The inorganic salts of cow's milk are more than three times as abundant as those of woman's milk. In the composition of these salts the most important difference is that there is present in cow's milk a relatively larger proportion of calcium phosphate and sodium chloride with a smaller proportion of potassium chloride.

The Salts of Cow's Milk (Weber and Fleischmann).

Potassium	17·34 to 24·50
Sodium	7·00 to 11·00
Calcium	17·30 to 27·00
Magnesia	1·90 to 4·07
Iron oxide	0·33 to 0·62
Phosphoric acid	26·00 to 29·13
Sulphuric acid	0·05 to 1·00
Chlorine	15·6 to 16·34

The reaction of cow's milk is neutral or slightly acid, practically never alkaline; woman's milk is neutral or alkaline.

Cow's milk as used always contains a large number of bacteria, which increase directly in proportion to the age of the milk; the milk of healthy women is practically sterile.

Cream.—A great misapprehension exists as to its composition. It is often spoken of as if it were entirely different from milk. It should rather be regarded as a milk which contains an excess of fat.

Cream is obtained either by skimming—the gravity process—or by the use of a centrifugal machine known as a separator. The latter process has the advantage in point of time, as centrifugal cream can be put upon the market from twenty-four to thirty-six hours earlier than gravity cream. It is, however, attended by a slight disadvantage, as it may break up mechanically some of the fat-globules, so that after heating they may form a thin oily layer at the top of the bottle. This is more likely to occur where centrifugal cream has been transported a long distance.

The following table gives the composition of an average milk and of centrifugal cream of different densities removed from the same milk :

	Whole milk.	CREAM.			
		I.	II.	III.	IV.
Fat.............	4·00	8·00	12·00	16·00	20·00
Sugar...........	4·30	4·30	4·20	4·00	3·80
Proteids.........	4·00	3·90	3·80	3·60	3·20
Salts............	0·70	0·70	0·64	0·60	0·55

These will be spoken of hereafter as 8-per-cent cream, 12-per-cent cream, 16-per-cent cream, etc., as indicating the amount of fat which they contain. The richest centrifugal cream contains from 35 to 40 per cent fat.

From the table it will be seen that cream differs from the milk from which it is taken mainly in containing more fat. The reduction in the proteids, even in the 20-per-cent cream, is less than 1 per cent. The changes in the other constituents are so slight that they may be ignored. In common speech the term *cream* is applied to any of these. The physician should know, if he is using cream for infant-feeding, the approximate amount of fat it contains. The 40-per-cent cream is the very thick, centrifugal cream sold in cities; 20-per-cent cream is the ordinary centrifugal cream; 16-per-cent cream is the common skimmed or gravity cream. In infant-feeding it is convenient to make use of a cream containing 12 per cent fat, and one containing 8 per cent fat. They may be obtained directly from fresh milk by the gravity process. If one quart of average milk is put into a glass jar and this into ice water or upon ice, after four or five hours there may be taken from the top about ten ounces of 8-per-cent cream; after six hours, about six ounces of 12-per-cent cream (Fig. 26). Both of these may be removed by skimming, or, better still, the milk from the bottom of the jar may be siphoned off, leaving the amount men-

FIG. 26.—Twelve-per-cent cream.

tioned.* If the milk is richer than the average the time may be shortened to three and five hours respectively. If it is poorer than the average the time must be lengthened.

None of the methods described for determining the quantity of fat in milk are applicable to cream, except the Babcock centrifugal machine.

MILK STERILIZATION.—The term *sterilization* is widely and rather loosely used to signify the heating of milk for the destruction of germs. It should, however, be borne in mind that none of the methods commonly employed render milk sterile in the bacteriological sense of the word, although this can be done by heating milk on two or three successive days as in preparing culture media. What is accomplished by the means commonly employed, is the destruction of such pathogenic germs as may be present, and a large number of the other bacteria, so as to retard for several days the ordinary fermentative changes. The preservation of milk for infant-feeding, by boiling it in small bottles, was advocated by Jacobi

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* A similar plan on a large scale may be followed in institutions by using an apparatus known as the "Cooley creamer." This consists of a wooden tank lined with metal, made of different sizes, holding two, four, or more cans of milk. The cans (Fig. 27) hold eighteen quarts, and are so covered that they can be submerged. The bottom of the can is inclined, and at the lowest point is placed a faucet. In the side is a glass window, so that the cream level can be distinctly seen. The cans are filled and placed in the tank of ice water; after six or twelve hours the lower portion is drawn off and the upper creamy layer left behind. In this way a cream of 8, 12, or 16 per cent may be obtained. The 8 and 12 per cent are those most convenient to use. If the milk is put in before the cream has risen once, after twelve hours from six to nine quarts of 8-per-cent cream may be obtained, and from four to six quarts of 12-per-cent cream; the variation being due to the difference in the milk employed. After six hours about two-thirds of the quantities mentioned can be obtained. The exact amount can be determined after a few experiments with any given milk by testing the strength of the cream each day with the Babcock machine. Then, with the same conditions of time, temperature, etc., the results will be quite uniform. If the milk is so old that the cream has already risen once, different results from those mentioned will be obtained. The plan is a simple one, involves very little trouble, and the milk during the time the cream is rising is kept at a low temperature.

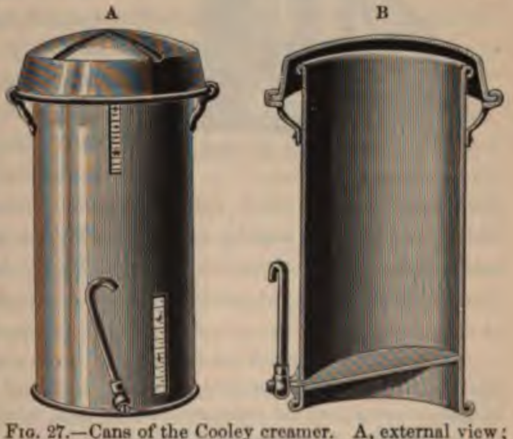

FIG. 27.—Cans of the Cooley creamer. A, external view; B, section view.

The Cooley creamer may be obtained at Bellows Falls, Vt.

many years ago. The adoption of systematic means for the destruction of germs in milk for infant-feeding has been largely due to the work of Soxhlet.

The most important of the germs in milk are the various saprophytic bacteria upon which are believed to depend a very large proportion of our diarrhœal diseases, the bacillus tuberculosis, which may be derived from the cow or may be an accidental contamination, and the germs of cholera, diphtheria, typhoid, and scarlet fever. All these flourish in milk at its ordinary temperature. There is pretty conclusive evidence that outbreaks of all the diseases mentioned have in certain cases been due to contaminated milk.*

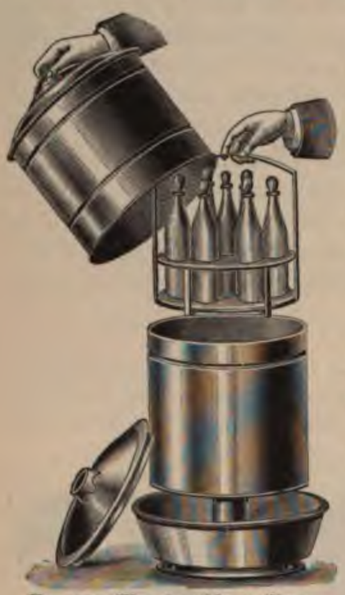

FIG. 28.—The Arnold sterilizer.

Following Soxhlet, all the earlier experiments in sterilization were made at a temperature of 212° F., continued for an hour and a half. So far as destroying germs was concerned this was quite enough. Such milk will keep for more than a week at ordinary room-temperatures. But it was soon found that some objectionable changes take place. The taste is that of boiled milk, to which many children strongly object; a certain proportion of the sugar is converted into caramel, causing a change in colour to a light brown; the casein is rendered less coagulable by rennet, and is acted upon more slowly and imperfectly both by pepsin and pancreatin. Certain changes probably take place in the fat also. Children fed upon "sterilized" milk are certainly more prone to constipation than others, this probably depending upon the difficulty in digesting the casein. There seems now to be little doubt that the nutritive properties of the milk are, to a certain degree at least, impaired by heating to 212° F. for an hour and a half. In a large city, with the milk supply which is available, it may be in summer a choice of evils whether infants shall be fed upon "sterilized" milk, with the disadvantages mentioned, or whether by giving contaminated raw milk we shall run the risk of introducing germs which produce diarrhœal diseases. The latter is certainly by far the greater danger.

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* The degree to which contamination takes place under ordinary circumstances may be judged from the investigations of Sedgewick and Batchelder in Boston in 1892. In fifteen specimens of ordinary country milk which were handled in the usual way and examined a few hours after it was drawn from the cow, the average number of bacteria to each cubic centimetre (about fifteen minims) was 69,143. The average number in fifty-seven samples of market milk as delivered from wagons in the spring of the year was 2,355,500. In sixteen samples of milk as sold by grocers—this being several hours older than the milk delivered from wagons—the average number of bacteria to each cubic centimetre was 4,577,000.

The principal source of contamination is undoubtedly from the cow and the stable during the process of milking. Dr. R. G. Freeman exposed for two minutes a Petri gelatin plate under a cow during milking and obtained 1,800 colonies. No doubt a great proportion of these germs are harmless, but with them others are often found which, if not strictly pathogenic, hasten fermentative changes in milk and greatly interfere with its digestibility.

The changes mentioned as occurring in milk are believed to begin at or about 180° F., and to be more marked the higher the temperature is carried and the longer it is maintained. Heating milk to 212° F. for an hour or an hour and a half, should be employed only in the hot weather and when it is necessary to keep the milk for a considerable time as in travelling, or when ice is out of the question, as among the very poor.

This method of heating milk is accomplished by the use of some apparatus by which steam is produced, the bottles being exposed on all sides in a close vessel. Probably the simplest and most satisfactory sterilizer is the "Arnold" (Fig. 28).

"Sterilizing" at a Low Temperature—Pasteurizing Milk.—To obviate the objections above referred to, the practice has come largely into use of raising the temperature only to 167° F. This is known as "Pasteurizing," and has been extensively used in and about New York and in Boston. The temperature of 167° F., maintained for twenty minutes, has been shown to be sufficient to destroy the bacilli of cholera, typhoid fever, diphtheria, tuberculosis, bacterium coli commune, and the ordinary pyogenic germs. It does not, however, destroy spores, and milk thus treated will keep at ordinary room-temperatures for two or three days only, but on ice for several days. A simple apparatus for this purpose (Fig. 29) * has been devised by Freeman, of New York. In this the temperature is raised by hot water, while cold water is used as the conducting medium. Milk heated to 167° F. has no objectionable taste, and according to Freeman's experiments with artificial digestion, the character of the curd and its digestibility do not differ from that of ordinary milk. This seems to be borne out by clinical observation.

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* Freeman's apparatus is used as follows: The pail is filled to the groove with water, which is then raised to the boiling point. The bottles of milk are dropped into their places in the cylindrical cups, sufficient water being poured into each cup to surround the bottle, this water acting as the conductor of heat. The pail is now removed from the stove and placed upon a board or other non-conductor, and the receptacle containing the bottles of milk is set inside and the cover replaced. The volumes of milk and water have been so calculated that in ten minutes they are both at a temperature of about 167° F. The water contains heat enough to maintain this, with very slight variations, for twenty minutes. In half an hour the bottles of milk are removed and cooled rapidly by being placed in a water-bath, the water being changed once or twice; or, better, by setting the pail in a sink and allowing the cold water to run from a faucet through a piece of rubber pipe into the pail, overflowing into the sink. This rapid cooling is very important. They are then put in the refrigerator. This apparatus may be obtained from James Dougherty, 411 West Fifty-ninth Street, New York.

The objections urged against heating to 212° F. do not hold against heating to 167° F., as most of the changes are thus avoided. However, the real question is whether there are any changes produced in milk so treated which detract from its value as an infant-food. Upon this point we must as yet speak somewhat guardedly, for experience with it is limited to a few years. To my knowledge, no sufficient evidence has yet been adduced to establish the fact that milk so heated has lost any of its essential nutritive properties, or that children fed exclusively upon it exhibit signs of either of the two most marked disorders of nutrition—rickets or scurvy; although I have seen two cases in which scurvy seemed to be clearly due to the use of milk heated to 212° F. for over an hour.

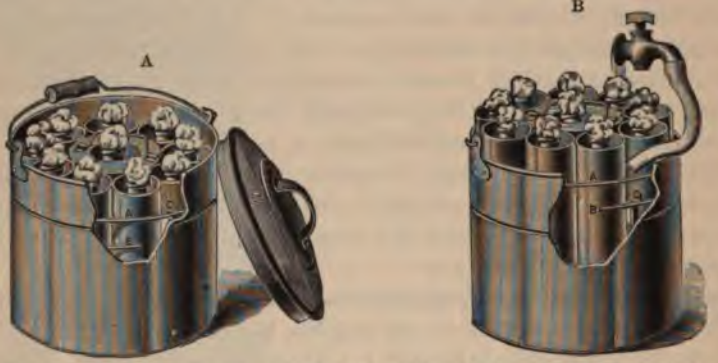

FIG. 29.—Freeman's Pasteurizer. A, bottles in position for heating; B, method of cooling.

It should be distinctly understood that sterilized milk requires the same modifications for infant-feeding as plain milk. There is no evidence to show that its nutritive properties or its digestibility are in any way enhanced by the process of heating. A great misapprehension seems to exist in the minds of many physicians with reference to this point. The opinion has gained a certain amount of currency that, if milk has only been "sterilized," it may be fed to a young infant without any further modification.

Sterilized milk can not be said to have any special therapeutic value in the gastro-enteric diseases of infancy. It is capable of causing just about as much disturbance as plain milk given in the same circumstances. Its chief value—and I think I may say almost its only value—is in preventing disease, first, by enabling us to feed infants upon milk in which, although it may be forty-eight hours old, no considerable fermentative changes have taken place, and, secondly, by destroying pathogenic germs with which the milk may have become accidentally contaminated.

The danger of transmitting tuberculosis to the infant by means of cow's milk is one that has, I think, been very greatly exaggerated. Animal experiments show that this is certainly possible, and there are a few isolated instances on record in which this seems to have been the mode of infection in children, but these cases are extremely rare. In one hundred and nineteen autopsies of my own upon tuberculous patients, nearly all of them infants, there was not found one with the primary lesion in the gastro-enteric tract. Northrup, in his large post-mortem experience, has seen but a single case. The danger of transmitting diphtheria, scarlet fever, and especially typhoid fever, by means of milk, is very much greater.

Summary.—Prolonged heating to 212° F. is objectionable and is not to be recommended for general use. It may be necessary especially in cities and in very hot weather, where ice is scarce and the milk very highly contaminated, also when the milk is to be kept for several days, as while travelling; for prolonged journeys, however, such as crossing the ocean, the milk should be heated to 212° F. for one hour on three successive days. Heating to 167° F. is quite sufficient for ordinary purposes. It is desirable that milk thus treated should be prepared daily, although it will keep on ice for four or five days. The fewer the germs in the milk at the time of heating, the shorter the time and the lower the temperature which will be necessary, hence the desirability of having the milk as clean and as fresh as possible. For the best results, the heating should be done at the dairy, so that the antecedent changes shall be reduced to the minimum. Without this precaution these changes are sometimes so great as to render the milk unfit for use. Heating milk for purposes of sterilization is at present imperative in cities during the warm months, as ordinary milk is from twelve to thirty-six hours old when received, and from twenty-four to seventy-two hours old before it is consumed. In the country it is a safeguard to be used when doubt exists in regard to the health of the cows or the handling of the milk; but where clean milk can be obtained fresh every morning from healthy cows, it is unnecessary. "Sterilized" milk requires the same modification for infant-feeding as plain milk. "Sterilization" is not to be regarded as a therapeutic measure; its value consisting in the prevention of disease. While I advise and constantly use milk which has been heated, my preference is strongly for that which is sufficiently pure, clean, and fresh to render this unnecessary. I believe that the direction in which we are to work is toward securing the greatest attention to the care and feeding of cows and to the handling of milk in order to prevent every possible contamination; and at the same time to have all cows whose milk is to be used for infant-feeding under close medical supervision. Until such a condition of things is realized, the heating of milk used for infant-feeding will be necessary.

PEPTONIZED MILK.—Milk is peptonized through the agency of a substance derived from the pancreas, usually of the pig. This is known in the market as "extractum pancreatis," the active ferment being the trypsine. As this acts only in an alkaline medium, bicarbonate of soda should first be added to the milk. The purpose of peptonizing is a partial or complete digestion of the casein of milk before feeding.

Partially Peptonized Milk.—This is done as follows:* One pint of fresh cow's milk and four ounces of water are put into a bottle, and a powder added containing five grains of extractum pancreatis and fifteen grains of bicarbonate of soda. This is kept at a temperature of 105° to 115° F. best by placing the bottle in water about as warm as the hand can bear comfortably. It should be shaken from time to time. For partial peptonization, the process is continued for from six to twenty minutes. The peptonizing powder is sold in glass tubes and in tablets. The tubes are to be preferred, as being less liable to deteriorate with age. Milk which has been peptonized ten minutes is not altered in taste; if, however, the process is continued for twenty minutes, a slightly bitter taste is noticed from the formation of peptone. This increases with the duration of the process of artificial digestion. If it is desired to arrest this after ten minutes, the milk may be raised to the boiling point, which destroys the ferment, or its activity may be stopped by placing the milk upon ice. If the milk is to be fed at once, neither of these procedures is necessary. If it is to be kept for several hours, scalding is more certain to arrest the change than lowering the temperature.

Completely Peptonized Milk.—The process is exactly the same as the above, except that it is continued for two hours, which is generally required for the conversion of all the proteids into peptones. The addition of acetic acid to such milk produces no coagulation. Although completely peptonized milk is quite bitter, this is not an obstacle to its use for young infants, who after the first or second bottle do not usually object to its taste. For those who are a little older, the bitter taste may be covered by lemon-juice and sugar—one even teaspoonful of cane sugar and two teaspoonfuls of lemon-juice being added to each four ounces of the milk.

Peptonized milk is to be diluted according to the age of the child. It is usually better to peptonize a milk-and-cream mixture which has previously been diluted with the proper amount of water. Peptonized milk is a valuable resource in chronic cases where there is feeble casein-digestion, and during attacks of acute indigestion in infancy. In acute attacks, completely peptonized milk is usually preferable to that which has been partially peptonized. It is not advisable to continue its use indefinitely; if this is done the stomach gradually becomes less and less able to do this work. At most, peptonization should be used only for a month or two at a time, as the case improves being gradually diminished by lessening the amount of the powder used and the time of peptonizing.

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* Fairchild's process.

CONDENSED MILK.—This is prepared by heating fresh cow's milk to 212° F. to destroy the bacteria and then evaporating *in vacuo* at a low temperature to a little less than one fourth its volume.* It is preserved in tin cans, usually with the addition of cane sugar in the proportion of about six ounces to a pint. The changes, therefore, to which the milk has been subjected are evaporation of a part of the water, partial or complete sterilization, and the addition of cane sugar. Fresh condensed milk to which no sugar had been added is delivered daily in New York and in other large cities.

The composition of condensed milk is shown in the following table; also the results obtained when it is diluted with six, twelve, and eighteen parts of water, as usually fed:

	Condensed milk.†	With 6 parts of water added.	With 12 parts of water.	With 18 parts of water.
	Per cent.	Per cent.	Per cent.	Per cent.
Fat	6·94	0·99	0·53	0·36
Proteids	8·43	1·20	0·65	0·44
Sugar { Cane, 40·44 Milk, 10·25 }	50·69	7·23	3·90	2·67
Salts	1·39	0·17	0·10	0·07
Water	31·30	90·49	94·82	96·46

The dilution with twelve parts of water is that most frequently employed, although eighteen is often used for very young infants.

The reasons both for the success and for the failure of condensed milk as an infant-food, are apparent from a study of its composition as it is ordinarily used. As a temporary food it is often useful, first because it has been sterilized, but chiefly because the casein of the cow's milk has been reduced by the usual dilution to such a point (about 0·6 per cent) that an infant with a very weak digestion can manage it, while it furnishes an abundance of sugar, the easiest thing for an infant to digest. During the first few months of life it is often apparently very successful for these reasons, but it can not be continued indefinitely without hazard. I have seen many infants reared exclusively upon it, but as yet not one who did not show, on careful examination, more or less evidence of rickets. Condensed milk fails as a permanent food, partly because it consists too largely of carbohydrates, but chiefly because it is lacking in fat. It is admissible only for temporary use during attacks of indigestion, for very young infants during the first two or three months, or among the very poor, where the cow's milk which is available is still more objectionable. It should never be continued as a permanent food where good, fresh cow's milk can be obtained, nor should it be used as a permanent food without the addition of fat (cream). In travelling it is often the most convenient as well as the safest food to use. It should then be diluted twelve times for an infant under one month, and from six to ten times for those who are older.

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* Process followed by the Borden Condensed Milk Company.

† Analysis made for the author by E. E. Smith, Ph. D., of Borden's Eagle-brand condensed milk.

The fresh condensed milk has not the disadvantage of the addition of a large amount of cane sugar, and requires essentially the same modification as ordinary cow's milk. For the poor in cities it is often the best infant-food available. For routine use it should be diluted with from eight to twelve parts of water, with the addition of sugar—preferably milk sugar—and if possible fresh cream.

KUMYSS.—The original kumyss was fermented mare's milk, and has been extensively used by the Tartars for centuries both as a food and a beverage. In this country kumyss is made from cow's milk. The ferment used by the Tartars was kefir grains, consisting of two forms of the ordinary yeast plant and great numbers of lactic-acid bacilli. The first kumyss made in the country was fermented by these grains, but they have now been discarded by most manufacturers of kumyss, as it is true that the bacteria which they contain are of no advantage and their effect may possibly be deleterious. Kumyss was formerly made chiefly from skimmed milk, but at present many manufacturers use the whole milk, with the addition of cane-sugar and a small proportion (about one sixteenth) of water. The process now most commonly employed is started with ordinary yeast, causing a vinous fermentation. This is carried on at a temperature of from 60° to 70° F. in corked bottles. At a little higher temperature the fermentation proceeds more rapidly, and may be completed in two or three days; but better results are obtained with the slower process, which requires a week or ten days.*

As thus manufactured, kumyss contains alcohol, carbon dioxide, lactic acid, and traces of butyric and acetic acids. The casein is first coagulated, and then broken up into minute particles by the agitation to which the kumyss is subjected during manufacture. Some of the casein is probably converted into albumoses or similar compounds.

Kumyss has an acid reaction and a peculiar taste somewhat resembling buttermilk; at first often disagreeable, but a fondness for it is soon acquired by the majority of those who take it. Its composition is as follows:

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* The following is perhaps the best formula for the domestic manufacture of kumyss: One quart of fresh milk, half an ounce of sugar, two ounces of water, a piece of fresh yeast cake half an inch square; put into wired bottles, keep at a temperature between 60° and 70° F. for one week, shaking five or six times a day, and then put upon ice.

Kumyss.

	Made from mare's milk (Koenig).	Made from cow's milk (Koenig).	Made from skimmed milk (Koenig).	Brush's kumyss (Doremus).
Fat	1·46	1·83	0·88	1·91
Proteids	2·24	2·66	2·89	2·04
Sugar	1·47	4·09	3·95	3·26
Alcohol	1·91	1·14	1·38	0·62
Lactic acid	0·91	0·55	0·82	....
Acid	....	....	....	0·30
Carbon dioxide	....	....	....	0·44
Salts	0·42	0·43	0·53	0·44
Water	91·29	89·30	89·55	90·99

The advantages of kumyss are due to the alcohol, carbon dioxide, and lactic acid which it contains, and to the changes which have taken place in the casein of the milk by which its digestibility is very much facilitated. It is more useful for older children than for young infants. It is a very valuable resource in many forms of acute and chronic indigestion. Kumyss is often retained when milk in any other form is vomited. In chronic cases it frequently stimulates the appetite and improves digestion.

For infants, kumyss should be diluted, generally with an equal quantity of water. Many take it better if the gas has been allowed to escape by standing a few minutes. When the stomach is very irritable it should be given, preferably cold, in small quantities and frequently—e. g., a tablespoonful every twenty or thirty minutes. It is important to secure a reliable article and one that is reasonably fresh.

MATZOON.—Matzoon is a form of fermented milk first used in Asia Minor. The process of the manufacture of matzoon is given by Dadirrian as follows: Cow's milk is employed, with the addition only of an imported ferment which consists probably of a form of yeast. The milk is first boiled half an hour for sterilization. The fermentation is begun at a temperature of about 105° F. and continued in an open vessel for twelve hours, the temperature being gradually reduced to about 70° F., after which it is cooled, bottled, and kept on ice. It is ready for use in twenty-four hours. A very slow fermentation continues after bottling, so that the older matzoon is more sour than that freshly made; older specimens contain also a little carbon dioxide. Matzoon keeps on ice for two or three weeks. It is a thick, curdy fluid with a taste somewhat resembling sour cream. For infant-feeding it should be diluted with water and fed with a spoon, as it is too thick to be drawn from a bottle.

The composition of Dadirrian's matzoon is as follows:*

Matzoon.

Proteids	3·48
Fat	3·49
Milk sugar	3·68
Lactic acid	0·90
Alcohol and other products of fermentation	0·13
Mineral salts	0·69
Water	87·63
	100·00

By the process to which the milk is subjected there is, as in the manufacture of kumyss, a decomposition of the milk-sugar into alcohol, lactic and carbonic acids. The changes in the proteids are quite similar to those in kumyss. In kumyss the fermentation goes on in the bottle, and consequently the carbonic acid is retained, while in matzoon the greater part of the gas escapes. The indications for the use of matzoon are the same as for kumyss.

JUNKET, CURDS AND WHEY.—Junket is made as follows: To one pint of fresh lukewarm cow's milk is added two teaspoonfuls of essence of pepsin or liquid rennet. It is stirred for a moment and then allowed to stand until firmly coagulated. It may be flavoured with wine, which should be added to it before coagulation. It is given cold. The only change which has taken place is the coagulation of the casein, such as occurs in the stomach as the first step in digestion. Junket is useful in the feeding of older children, but should not be given to infants.

WHEY.—The milk is coagulated as above directed, the curd is then broken up with a fork, and the whey strained off through coarse muslin. To this whey may be added wine or brandy. From forty-six analyses Koenig gives the composition of whey as follows:

Whey.

Proteids	0·86
Fat	0·32
Sugar	4·79
Salts	0·65
Water	93·38
	100·00

Whey is especially valuable for infants suffering from acute indigestion. It may be given in small amounts frequently, and will often be retained when everything else is vomited. It should be given cold. Wine whey is made by the addition of sherry wine, usually in the proportion of one part to sixteen.

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* Analysis of Leeds.

BEEF PREPARATIONS.

The nutrient properties of these preparations are to be measured by the amount of albumin they contain, their stimulant properties by the proportion of extractives.

Beef Juice.—Expressed beef juice is made as follows: A piece of lean steak is slightly broiled, and the juice pressed out by a meat-press or a lemon-squeezer. Two or three ounces can ordinarily be obtained from one pound of steak. This is seasoned with salt and given cold or warm, but not heated sufficiently to coagulate the albumin in solution.

Another excellent method of making beef juice without cooking, is by taking one pound of finely chopped lean beef and eight ounces of water and allowing this to stand in a covered jar upon ice from six to twelve hours. The juice is then squeezed out by twisting the meat in coarse muslin. It is seasoned with salt and given like the above. This is not quite so palatable as that obtained by the first method, because it contains a smaller proportion of extractives. It can be made so, however, by the addition of sherry wine or celery salt. If the raw juice is added to milk in the proportion of two or three teaspoonfuls to each feeding, the taste will not be noticed. The milk should not be warmed above 100° F. before the addition of the juice.

The composition of the two products is shown in the following table:

Beef Juice.[*]

	I. Expressed juice from 1 lb., warm process: quantity, 2½ oz.	II. Cold process, 1 lb. beef, 8 oz. water; quantity, 8⅝ oz.
Proteids	2·90	3·00
Fat	0·60	....
Extractives	3·40	1·90
Salts	0·20	0·20
Water	92·90	94·90
	100·00	100·00

The only difference in the two preparations is that the first contains about twice as much of the extractives. The second process is much more economical, as more than three times as much juice can be obtained from a given quantity of beef. If a stronger juice is desired, the amount of proteids may be doubled by using only four ounces of water. This is preferable for all except young infants.

Beef extracts are not to be considered in any sense as foods. Kemmerich has shown that animals receiving nothing else died of starvation, and even sooner than when everything was withheld. According to Chittenden, they contain no nitrogen in the form of proteids, but only in combination with the soluble extractives. They are stimulants, and as such are often useful.

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[*] Analysis made for the author by E. E. Smith, Ph. D.

Of the other preparations of beef in the market probably the best are Mosquera's beef jelly, bovinine, the beef peptonoids of the Arlington Company, and Murdock's liquid food. These contain from ten to thirty-five per cent of proteids available for nutrition. They are valuable additions to milk in the artificial feeding of infants. They also furnish a proteid which can be used in many cases of indigestion where milk is not admissible. For infants they must be well diluted. They are valuable in older children in many cases of general malnutrition.

Raw scraped beef, or that which has been slightly cooked, is easily digested by most young children. There are many conditions in which other forms of proteid, particularly casein, are not well borne, and indeed can not be taken at all, where children even as young as twelve months appear to digest this beef-pulp without any difficulty. It should be made from very rare or raw steak, finely scraped and well salted. A tablespoonful may be given at one feeding to a child of eighteen months. In nutrient properties this far exceeds most of the beef preparations in the market. The alleged danger of tapeworm from the use of raw meat, is in this country so slight that it may be disregarded.

Broths.—Animal broths may be made from mutton, veal, chicken, or beef. A good formula for general use is the following: One pound of lean meat, one pint of water; stand for four or five hours, then cook over a slow fire for one hour down to half a pint. After it has cooled, skim off the fat and strain through a cloth. The composition of a broth so made is given by Cheadle as follows:

Beef Broth.

Proteids	1·02
Extractives	1·82
Fat	....
Salts	0·88
Water	96·28
	100·00

From its composition it will be seen that broths are not very nutritious; they are, however, quite stimulating, and are at times useful, particularly where milk is to be temporarily withheld; but they are not adapted to prolonged use. Broths which have been thickened with either barley or rice flour are useful for children in the second and third years.

CEREALS.

Barley Water.—This is to be made either from the grains or from the barley flour. When the grains are used, the following is the formula which I have been accustomed to employ: To two tablespoonfuls of barley, add one quart of water, and boil continuously for six hours, keeping the quantity up to the quart by the addition of water; strain through coarse muslin. It is an advantage to soak the barley for a few hours, or even over-night, before using. The water in which it is soaked is not used. When cold this makes a rather thin barley jelly. Its composition by analysis is as follows:

Barley Water.

Starch	1·63
Fat	0·05
Proteids	0·09
Inorganic salts	0·03
Water	98·20
	100·00

Almost an identical product may be obtained by using either the prepared barley flour of the Health Food Company, New York, or Robinson's barley, two drachms—one even tablespoonful—to each twelve ounces of water, and cooking for fifteen minutes. This is certainly a simpler and easier method of preparation.

Rice Water, Oatmeal Water, etc.—These may be made in the same manner as the barley water, using the same proportions either of the flour or the grains. Salt should always be added to these gruels if used alone. These substances are useful, being a convenient form in which starch may first be added to the food of infants when old enough to digest it, i. e., about the eighth or ninth month. They may also be used, when more dilute, to allay thirst when the stomach is irritable, and when milk in all forms must be temporarily withheld. Rice water and barley water are usually preferable in cases of diarrhœa, and oatmeal water where there is a tendency to constipation.

INFANT-FOODS.

It is not possible, nor even desirable, for a physician to know all about the infant-foods with which the market is flooded. He should, however, at least know that they are not perfect substitutes for breast-milk, that as permanent foods they are greatly inferior to properly modified cow's milk, and that as often used by the laity, and even by the medical profession, they are capable of doing and have done much positive harm. There are two diseases—rickets and scurvy—which have so frequently followed their prolonged use, that there can be no escaping the conclusion that they were the active cause. This is the unanimous verdict of all physicians whose experience entitles them to speak with authority upon the subject of infant-feeding. On the other hand, there are times when some of these preparations may be of considerable value, but chiefly for temporary use in pathological conditions. Here they are to be prescribed like drugs, but only with a very definite knowledge of exactly what they do and what they do not contain. The most commonly used infant-foods may be grouped as follows:

1. **The Milk Foods.**—Nestlé's food is perhaps the most widely known. The others closely resembling it in composition are the Anglo-Swiss, the Franco-Swiss, the American-Swiss, and Gerber's food. These foods are essentially, sweetened condensed milk evaporated to dryness, with the addition of some form of flour which has been partly dextrinized; they all contain a large proportion of unchanged starch.

2. **The Liebig or Malted Foods.**—Mellin's food may be taken as a type of the class. Others which resemble it more or less closely are Liebig's, Horlick's food, Hawley's food, and malted milk. Mellin's food is composed principally (80 per cent) of soluble carbohydrates. They are derived from malted wheat and barley flour, and are composed of a mixture of dextrines, dextrose, and maltose, with a small amount of cane sugar.

3. **The Farinaceous Foods.**—These are imperial granum, Ridge's food, Hubbell's prepared wheat, and Robinson's patent barley. The first consists of wheat flour previously prepared by baking, by which a small proportion of the starch—from one to six per cent—has been converted into sugar. In chemical composition these four foods are very similar to each other, consisting mainly of unchanged starch which forms from seventy-five to eighty per cent of their solid constituents.

4. **Miscellaneous Foods.**—Under this head may be mentioned (1) Carnrick's soluble food, which is composed mainly of carbohydrates, more than one half being unchanged starch, the fat being chiefly cocoa butter; (2) lacto-preparata, which differs from the above chiefly in the fact that the starch has been replaced by milk sugar; (3) lactated food, which is composed of about seventy-five per cent carbohydrates, nearly one half of which is unchanged starch.

*The Composition of Infant-Foods.**

	Nestlé's food.		Mellin's food.		Malted milk.		Ridge's food.		Imperial granum.		Lacto-preparata.		Carnrick's soluble food.
		Per cent.		Per cent.		Per cent.		Per cent.		Per cent.		Per cent.	Per cent.
Fat		5·48		0·31		2·66		1·11		1·04		12·35	7·45
Proteids		11·04		10·70		15·18		11·93		14·13		14·51	10·25
Dextrines	7·38		40·96		31·97†		1·23		1·38		.....		....
Dextrose and maltose	....		37·38		31·79		0·52		0·42		.....		....
Cane sugar	30·59		4·23		4·15		1·16		Trace.		.....		....
Milk sugar	7·60		.....		.....		....		....		63·68		....
Total soluble carbohydrates		45·57		82·57		67·91		2·91		1·80		63·68	27·08
Insoluble carbohydrates (starch)		29·95		....		....		77·96		76·11		...	37·37
Inorganic salts		1·72		3·20		3·34		0·49		0·39		3·66	4·42
Moisture		1·50		4·09		2·20		8·58		8·38		5·80	3·42

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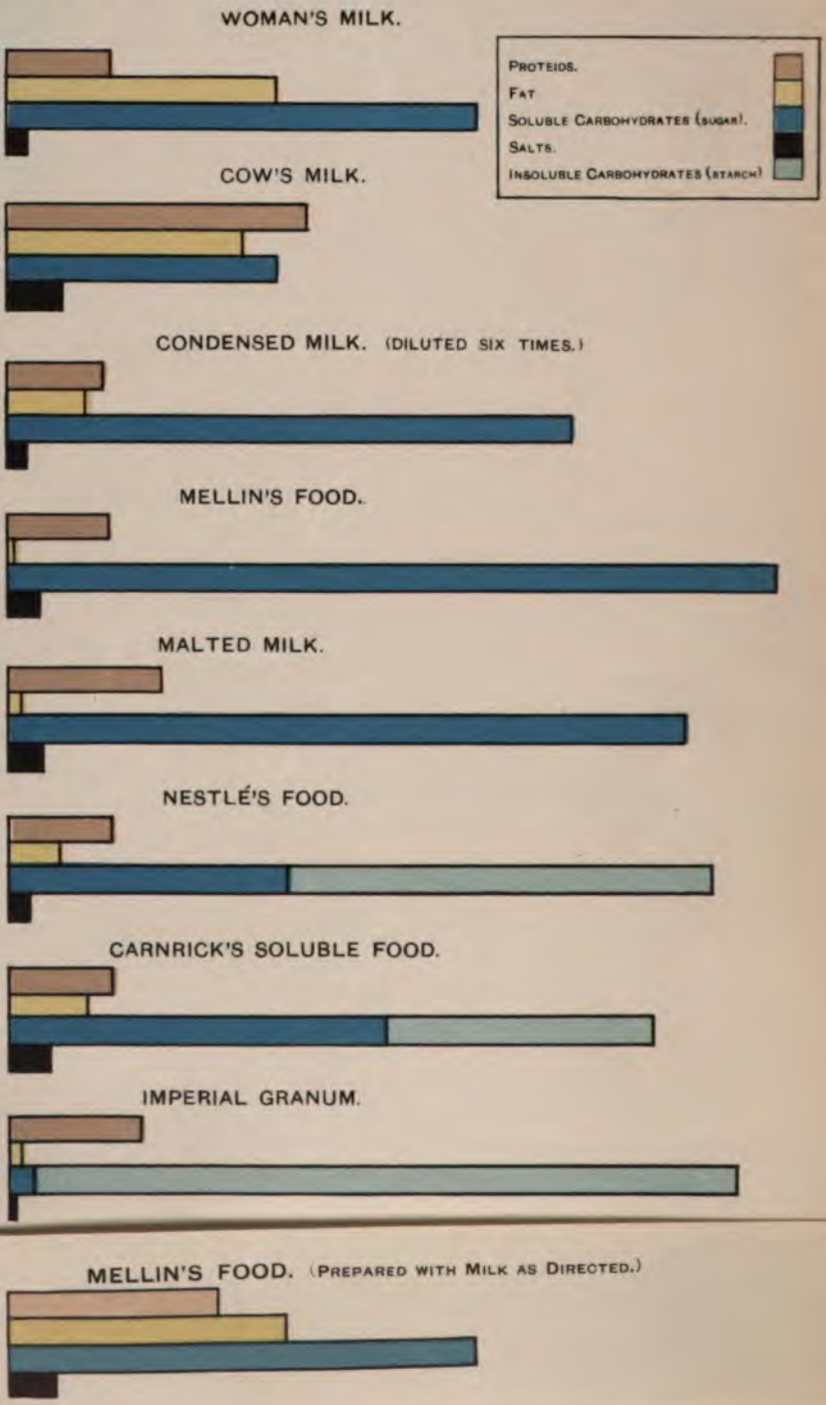
* With the exception of lacto-preparata and Carnrick's soluble food, which are taken from Leeds, all these analyses were made for the author by E. E. Smith, Ph. D. In general they correspond with those previously published by Leeds, Rach, Trimble, Stutzer, and others.

† Including milk sugar.

PLATE III.


WOMAN'S MILK.
PROTEIDS.
FAT
SOLUBLE CARBOHYDRATES (SUGAR).
SALTS.
INSOLUBLE CARBOHYDRATES (STARCH)
COW'S MILK.
CONDENSED MILK. (DILUTED SIX TIMES.)
MELLIN'S FOOD.
MALTED MILK.
NESTLÉ'S FOOD.
CARNRICK'S SOLUBLE FOOD.
IMPERIAL GRANUM.
MELLIN'S FOOD. (PREPARED WITH MILK AS DIRECTED.)

A better idea can be obtained of these foods by the study of the following table, where they are diluted with water for comparison with milk:

Infant-Foods diluted with Water to compare with Milk.

	Breast milk.	Cow's milk.	Condens. milk, diluted 6 times.	Mellin's food.	Malted milk.	Nestlé's food.	Ridge's food.	Imperial granum.	Carnrick's soluble food.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fat	4·00	3·50	0·99	0·04	0·39	0·76	0·16	0·14	1·12
Proteids	1·50	4·00	1·20	1·50	2·28	1·54	1·67	1·98	1·35
Soluble carbohydrates (sugars)	7·00	4·30	7·23	11·56	10·18	6·38	0·41	0·25	4·06
Insoluble carbohydrates (starch)	....	....	....	....	....	4·19	10·91	10·65	5·61
Inorganic salts	0·20	0·70	0·17	0·45	0·50	0·24	0·07	0·06	0·56
Water	87·30	87·50	90·41	86·45	86·65	86·89	86·78	86·92	87·30

The accompanying graphic chart (Plate III) shows in another form the same thing as the last table. In it are seen at a glance the essential features in the composition of most of the foods, viz., the large proportion of carbohydrates and the absence of fat. As a class then, infant-foods contain an excess of carbohydrates, and many of them a large percentage of unchanged starch. The proteids, though often sufficient in amount, are chiefly vegetable, and not animal proteids. Without exception they are lacking in fat, and therefore they do not furnish all that the growing organism requires. They should not be used except in those forms of indigestion where we desire temporarily to withhold fat and casein and to employ as food only carbohydrates. They can not be used as exclusive foods for any considerable period without disastrous results. Their continued use without some addition of fresh milk should never in any circumstances be countenanced. While some of them may furnish the additional carbohydrates required by an infant who is fed upon diluted cow's milk, they can not do more. The group of farinaceous foods, as they furnish starch in a convenient and palatable form, may often be advantageously used as an addition to milk after the ninth month and during the second year.

CHAPTER III.

INFANT-FEEDING.

THE different methods of feeding which are available are:

1. Breast-feeding, either by the mother or by a wet-nurse.
2. Mixed feeding, or a combination of nursing and artificial feeding.
3. Artificial feeding exclusively.

In deciding which one of these methods shall be used, all the conditions, such as the health of the mother, the vigour of the child, and its surroundings, must be taken into consideration. The first choice should always be maternal nursing. If it is not possible for the mother to nurse her infant entirely, nursing may be supplemented by feeding either from the outset or after the third or fourth month. If the conditions are such that maternal nursing is impossible or impracticable, the question to be decided is one of

Artificial Feeding *vs.* **Wet-nursing.**—Neither method of feeding is to be used exclusively. While recent advances made in artificial feeding have greatly diminished the necessity for wet-nurses, there are still many instances where, objectionable though they may be, they are indispensable for saving the life of the child, as the perfect substitute for good breast milk is as yet undiscovered.

If artificial feeding can be begun at birth and carried on according to the most approved methods, it is highly successful in the great majority of cases in which maternal nursing is impossible. In my experience, fully ninety per cent of the infants seen in private practice can with care be so reared. The remainder of the cases will require wet-nurses; these including chiefly infants who are prematurely born or those who are delicate from birth, and those with especially weak digestion, who are reared only with the greatest difficulty under any circumstances. This statement applies particularly to infants living in large cities. If, however, artificial feeding has been badly begun, and so carried on for two or three months that, when the child comes under observation, a condition of chronic indigestion is established, the difficulties in the way of artificial feeding are much increased, and the proportion of cases in which wet-nurses are required will be much larger. Whether or not a wet-nurse shall be employed at this juncture will depend upon the circumstances surrounding each case. If the child has steadily lost flesh so that it weighs only a little more than at birth, if it lives in a large city, or if the season is midsummer, the necessity for a wet-nurse is very much increased. In these circumstances, the great danger is the supervention of some acute disease of the stomach or intestines, to which a child in this condition is very liable, and which it may not be able to survive. Unless such a child begins very soon to improve with proper methods of artificial feeding, a wet-nurse should be secured. If the child lives in the country, if the weather is cool, and if the child is holding its own in weight, a faithful trial of proper feeding should be made before resorting to a wet-nurse. If the child, at the time of coming under observation, is suffering from an attack of acute indigestion, or from the symptoms of acute inanition, a wet-nurse should be obtained at once. I believe that the day will soon come when no physician will lay before his patient the choice of a wet-nurse or artificial feeding in the case of a healthy infant whose mother can not or will not nurse it; but that the general attitude of the profession will be, artificial feeding if possible, wet-nursing only if necessary. I am well aware that this practice is not followed by many of the leading physicians in New York, who still adhere to the practice of employing wet-nurses in every instance in which maternal nursing is impossible. This is largely due to a want of familiarity with the methods and results of the best artificial feeding, while the results of improper artificial feeding are to be seen on every hand.

The disadvantages in the employment of wet-nurses are many, and almost as difficult to overcome as those attending artificial feeding. In the first place, good ones are difficult to obtain, and outside of a large city it is almost impossible to obtain one of any kind. While it is true that good breast milk is unquestionably the best infant-food, it is equally true that properly modified cow's milk is a far better food than the milk of many wet-nurses who are employed. The expense of wet-nurses—twenty to thirty-five dollars a month in New York—places them out of the reach of many who need them most; and, finally, the class of women from which most of our wet-nurses are drawn, are very undesirable inmates of a household, and are often the source of endless trouble and annoyance—a nuisance which must be tolerated for the sake of the baby. The danger of the transmission of disease from the nurse to the child is a real one. Numerous instances are on record of syphilis being communicated in this way, and some have come under my own observation. It is possible that tuberculosis may be transmitted through the milk, although, like syphilis, this is much more liable to result from other contact with the nurse, especially kissing.

The moral question involved in the subject of wet-nursing is one which neither the physician nor the family who employ the nurse can ignore, for it is no small thing to deprive an infant of its mother's breast when, as statistics show to be true of the children of wet-nurses, this fact reduces its chance of survival to one in ten. The family should be compelled by the physician to consider this aspect of the question, and to see to it that proper provision for the care of the wet-nurse's child is made, so as to give it the best possible chance with artificial feeding. If the wet-nurse's child is two months old, its chances of getting on without the mother are vastly improved, while her usefulness as a wet-nurse is not thereby diminished. It should therefore be required that, whenever circumstances permit, every woman who goes out as a wet-nurse should nurse her own infant for at least two months before she leaves it.

The unnecessary employment of wet-nurses is no doubt an evil, and has a bad influence upon those who make wet-nursing a business, as many women in cities are tempted to do on account of the large wages which they are able to earn for very easy work. If a wet-nurse were retained in her place only as long as the needs of the child required—i. e., until it had arrived at a sufficient age, and its digestion had sufficiently improved to enable it to thrive upon modified cow's milk—she could be dispensed with in a month or two months, and could then seek another place. In this way a small number of nurses could be made to do duty for quite a large number of children. This is practically just what is done in several of our large institutions, where a delicate child is wet-nursed only long enough to give it a start, which may require two weeks, one month, or three months, as the case may be. And just in this way should wet-nurses be used in private practice, as furnishing an infant-food easy of digestion, and one without which sometimes we can not get along.

BREAST-FEEDING.

I. Maternal Nursing.—Maternal nursing is desirable whenever it is possible. Under the following conditions, however, it should not be attempted:

(1) No mother who is the subject of tuberculosis in any form, whether latent or active, should nurse her infant; it can only hasten the progress of the disease in herself, while at the same time it exposes the infant to the danger of infection. (2) Nursing should not be allowed where serious complications have been connected with parturition, such as severe hæmorrhage, puerperal convulsions, nephritis, or puerperal septicæmia. (3) If the mother is choreic or epileptic. (4) If the mother is very delicate, since great harm may be done to her, without any corresponding benefit to the child. (5) Where experience on two or three previous occasions under favourable conditions has shown her inability to nurse her child. (6) When no milk is secreted. With reference to the fourth and fifth conditions an absolute opinion can not always be given at the outset. In cases of doubt, nursing may be allowed tentatively, the effect upon both mother and child being carefully watched. In view of the great value of maternal nursing to the child, the physician should encourage it and use every means in his power to make it easy.

Care of the Breasts during Lactation.—For the safety of both mother and child it is essential that the most scrupulous attention be given to cleanliness. The nipples, and the breasts as well, should always be carefully washed after each nursing. Usually plain water is sufficient, or a weak boric-acid solution may be employed.

Nursing during the First Days of Life.—This is necessary, to accustom the child and the mother to the procedure, to promote uterine contraction, and to empty the breasts of the colostrum. All these results can be attained by putting the child to the breast on the first day once in six hours, on the second day once in four hours. It is unnecessary to repeat the process more frequently. The child gets from the breast only from four to six ounces a day during the first two days. Did it require more nourishment before the milk-flow is usually established, we may be sure that Nature would not have been so late with her supply. Considering how great are the changes taking place during these first days in the circulatory and respiratory systems, we are hardly surprised that two days pass before the organs of digestion are given much work to do. The common practice of administering to an infant a few hours old all sorts of decoctions, with the idea that because it cries it is suffering from colic, can not be too strongly condemned. A certain amount of crying is proper and necessary. In exceptional circumstances, when an infant is unusually strong and robust and screams excessively, and especially when the temperature is elevated (see page 121), it may be necessary to give food before the third day; but this is not to be the rule. A little warm water, or a five-per-cent solution of milk sugar, should first be given; from two to four teaspoonfuls at a time are sufficient. This often satisfies the child; when it does not do so, regular feeding should be begun on the second day. Should the milk be delayed beyond the second day, feeding should then be begun at regular intervals, as in the cases which are to have no breast-milk.

Nursing Habits.—Good habits of nursing and sleep are almost as easily formed as bad ones, provided one begins at the outset. A vast deal of the wear and tear incident to the nursing period may be avoided if the child is trained to regular habits. Attention to these minor points often makes all the difference between successful and unsuccessful nursing. They should not be thought beneath the physician's notice, nor relegated entirely to the nurse. The physician must have a very clear notion of how often nursing is necessary, must give very explicit directions, and see that they are carried out. After the third day, for the first month, ten nursings in the twenty-four hours are quite sufficient, and no more should be allowed. An infant at this age can usually be depended upon to take at least one long nap of from four to five hours in the course of the twenty-four. For the rest of the day the child may be awakened, if necessary, at the regular nursing time, and put to the breast; this plan being continued until nine o'clock at night. It should then be allowed to sleep as long as it will, and but two nursings given between this hour and seven in the morning. In the course of two or three weeks a healthy infant can usually be trained to nurse and sleep with almost perfect regularity, frequently, when a month old, going six hours regularly at night without feeding. A trained nurse of my acquaintance states that out of thirty-three infants of which she had the care from birth, thirty-one were trained without difficulty in the manner described. In only one case was the training a failure—that of a delicate, highly nervous child. Of course, success in training must rest almost entirely with the nurse; but the physician should at least appreciate its importance and lend it his support. The great gain to the mother is, that she is enabled to have a quiet, undisturbed night. This is of the utmost importance, and has more to do with a good milk supply than any other single thing in connection with the mother's habits. So far as the child is concerned, regular habits of feeding and sleep, and regular evacuations from the bowels, which nearly always go with them, are important factors in infant hygiene, especially in the prevention of gastro-enteric diseases.

Schedule for Breast-Feeding.

AGE.	Number of nursings in 24 hours.	Interval during the day.	Night nursings between 9 P. M. and 7 A. M.
		Hours.	
First day	4	6	1
Second day	6	4	1
Third to twenty-eighth day	10	2	2
Fourth to thirteenth week	8	2½	1
Third to fifth month	7	3	1
Fifth to twelfth month	6	3	0

These rules can be carried into effect with but little difficulty, and with great benefit to both mother and child. It is to be remembered that we are here speaking only of healthy children. The possibility of training children to eat and sleep in the manner described will be doubted only by one who has not made a careful trial of it. Relieving the mother of night-nursing after the child is five months old is of the greatest value, and will often enable her to go on with lactation, when otherwise it would be brought to an abrupt termination. On no account should the child be allowed to sleep upon the mother's breast, nor in the same bed with the mother. The temptation to frequent nursing is in this way in great measure removed. No mere sentiment in regard to these matters should be allowed to interfere with the plain dictates of reason and experience.

Symptoms of Inadequate Nursing.—So frequently does it happen that a mother is anxious to nurse her child, and after two or three months it is discovered that lactation is a failure and artificial feeding must be resorted to, that it is important that the question of ability to nurse should be settled as early as possible. The lives of children are often jeopardized by the vain efforts of a conscientious mother to do what she is physically unable to do. The physician should be familiar with the symptoms of inadequate nursing, in order that valuable time may not be wasted. If artificial feeding is to be employed, the difficulties are much less when it is begun early than after the digestion has been deranged by several weeks of very poor nursing.

1. During the first three or four days of life the most important sign of insufficient food is the *temperature*. As a rule, a child who gets a proper amount from the breasts has a normal temperature. Very many who get little or nothing during this time have a temperature of 101° or 102° F., and, in extreme cases, 104° or even 106° F. If no obvious symptoms of illness are present, such a temperature from the second to the fourth day may be looked upon as indicating insufficient nourishment, or even starvation. (See page 118.)

2. *There is no gain in weight.* All infants, and particularly those whose nutrition is the subject of special difficulty, should be weighed twice a week during the first six months. No matter what other symptoms are present, the scales are an unerring guide by which we are to judge the results. A child need not gain rapidly, but should always gain steadily unless obvious signs of disease are present. One should not be satisfied unless the weekly gain is at least four ounces. In the great majority of cases a failure to gain in weight during the first six months, depends upon the nourishment, and upon that alone.

3. *The sleep is irregular and disturbed.* A healthy infant, after its appetite has been satisfied, usually goes to sleep at once and sleeps quietly for two or three hours; or, if awake, it lies in placid contentment, exhibiting all the signs of physical well-being. If, after being nursed, a child wakes habitually fifteen or twenty minutes after being put down, and rarely has a long sleep except from exhaustion, the probabilities are great that the food is insufficient in quantity or very poor in quality.

4. *There is frequent fretfulness or crying.* This may, of course, be due to many causes in infancy, but by all odds the most common one is lack of proper food or the indigestion which this produces.

5. *The stools are irregular and of an unhealthy appearance.* There may be constipation with dry, hard stools, or frequent green fluid stools, from four to twelve a day, often containing undigested food, and after a time mucus.

6. *The child nurses a long time before it is satisfied.* Usually the greater the milk supply, the shorter the time required to satisfy the child's appetite. Where the milk is abundant, five or six minutes are often sufficient. If the milk is very scanty, an infant will frequently nurse half or three quarters of an hour and then stop, more because it is tired out than because it is satisfied. If this is habitual, it is almost certain that the milk is very scanty. Sometimes a scanty supply is indicated by exactly the opposite symptom, viz., the child seizing the breast and nursing vigorously for a few moments, then dropping the nipple in apparent disgust and refusing to make any further efforts. This symptom is often seen where the breasts are practically empty.

7. *The symptoms during the later months* are stationary weight or a gradual loss, soft, flabby muscles, inability to sit alone or to stand at the proper age, delayed closure of the fontanel, delayed dentition, and frequently perspiration about the head. In addition, there are the general signs of malnutrition, anæmia, fretfulness, and irregular bowels, or there may be added the symptoms of incipient rickets.

The above symptoms are sufficiently characteristic to enable one to be quite sure of the fact that the child is not thriving. The proper course now is to examine the milk and see in what respect it is abnormal: whether it is simply the quantity that is at fault, or the quality, or both. While such an examination does not always solve the problem, it is of very great assistance, and in the majority of cases two or three examinations of the milk, in connection with the other symptoms, will enable the physician to decide the question and apply the appropriate treatment.

The Management of Woman's Milk where Nursing Infants are not Thriving.—The milk examination usually discloses one of four conditions: (1) an over-rich milk, quantity usually abundant; (2) milk poor in quality and scanty; (3) quality good, amount scanty; (4) quantity abundant, quality poor.

Excessively rich milk.—This is usually found under the following conditions: The woman is in good health, has large, well-developed breasts, which are full and tense at nursing time. In most cases she is upon a very abundant diet, largely of nitrogenous food, getting little or no exercise, and frequently taking alcohol with the notion that because the child is not thriving the milk is poor. This is often seen in the wet-nurse after making a change from the simple life and habits of home to the more luxurious life and diet of the family to which she goes. The following analyses from Rotch are a good illustration of the exact composition of milk under such circumstances: Analysis I shows milk of a healthy but under-fed wet-nurse two days before change of food; II, the milk of the same nurse after one month of rich food with very little exercise; III, milk of the same nurse, the food and exercise being regulated:

	I.	II.	III.
	Per cent.	Per cent.	Per cent.
Fat	0·72	5·44	5·50
Proteids	2·53	4·61	2·90
Sugar	6·75	6·25	6·60
Salts	0·22	0·20	0·14

The effect of the diet and life is seen to be, high fat and high proteids. As a result of the exercise, there is seen a very marked reduction in the proteids. The clinical examination shows the cream to be from eight to twelve per cent, and the specific gravity from 1,032 to 1,033. Instead of weaning the baby, or dismissing the wet-nurse because the child has indigestion or loses in weight, certain changes should be instituted. Alcohol should be entirely prohibited. The diet, especially the meat, should be reduced, and the nurse required to take daily exercise in the open air, particularly by walking. The improvement following such a regimen is often immediate, the child's symptoms disappearing in the course of a few days and a regular gain in weight beginning.

Scanty milk of a poor quality.—This is most often seen in a delicate or anæmic mother—one, perhaps, who has had a difficult or complicated labour, who is emotional, anxious, and careworn. In such cases it is often with the greatest difficulty that we can secure the necessary half ounce required for examination. The milk is sometimes so poor that we can decide positively after two examinations that it is useless to continue lactation. In such cases we often find the specific gravity from 1,024 to 1,027, and the cream only two or three per cent. In other cases, where the variations from the normal are not so great—i. e., specific gravity 1,030, cream four per cent, and the quantity fairly abundant—we may be able so to improve the milk that lactation may be easily and advantageously continued. In the management of such cases the first thing is to secure to the nurse undisturbed rest at night. If possible, she should be entirely relieved of the care of the infant at this time, and if feeding is necessary the bottle should be given. She should have a certain amount of fresh air every day, driving if possible, or walking as soon as she is able to take more active exercise. One of the most powerful stimulants to the secretion of milk is massage of the breasts. A. M. Thomas (New York) places it above all others. It should be done with great care and gentleness, but most of all with every precaution against infection. The entire breast, including the nipple, should be rendered aseptic, as should the hands of the *masseuse*. Some mild antiseptic ointment may be used with the massage. It should be done two or three times a day for ten minutes. The diet should be abundant, with a large allowance of milk and meat, especially beef. If there is anæmia, iron should be given. Some of the alcoholic extracts of malt are useful. Every means should be taken to improve the general nutrition, for whatever benefits this improves the milk. If the conditions present are incident to the confinement or the convalescence, the prognosis is good; and in the course of a week or two very marked improvement may be evident, and lactation may be successfully continued. If, however, the conditions depend upon constitutional debility, or if the person has an exceedingly nervous temperament, the prognosis is much worse. Temporary improvement may take place, but it soon becomes evident that the experiment is a failure, both as regards mother and child.

Quantity deficient, quality normal.—This is often apparently the case, but really it is rarely so. If, in taking the specimen for examination, the child is first allowed to nurse for one or two minutes as has been suggested, there may be left only the final portion, or "strippings," which part is always much richer in fat than the whole milk. An examination of such a specimen often gives an excellent showing when the milk is really poor. In all cases of scanty supply, the entire quantity from the breasts should be secured for examination. If the only object in treatment is to increase the quantity, this can usually be accomplished by largely increasing the fluids, especially milk, and by taking alcoholic malt extracts.

Quantity abundant, quality very poor.—This condition is usually seen in women who, to improve the milk, have been taking large quantities of fluids, often with alcohol in some form. In such cases, instead of being a formation from the epithelium of the glands, the milk is chiefly a transudation from the blood-vessels. Where the patient is very anæmic and the general condition poor, the glands act as little more than a filter. In such circumstances the breasts may be so full as to be painful, and the milk may often come away spontaneously. An examination usually shows low specific gravity and very low fat. Where these conditions exist nursing should be discontinued.

Summary.—Excessively rich milk is in most cases easily modified by a reduction in the diet and increase in exercise. Poor milk is usually low in fat and scanty in quantity, while the proteids may be either high or low. If the variations from the normal are only moderate, and the causes are such as can readily be removed, the prognosis is good. If the opposite conditions exist, the prognosis is bad, and the chances of permanent improvement are slight. On the whole, artificial feeding gives so much better results than poor or doubtful nursing, that I am inclined, as a result of increased experience, to stop nursing and begin artificial feeding early, rather than waste time in prolonged efforts to improve the breast-milk. Nursing that is continued only by high pressure, by stimulants, and by deluging the mother with fluids, is rarely advantageous either for mother or child.

II. WET-NURSING.—In the selection of a wet-nurse, it is by no means so essential as has generally been supposed, that her child shall be of about the same age as the child she is to nurse, for, after the first month, the changes in the composition of breast milk are insignificant. It is always desirable that the wet-nurse shall have nursed her own infant long enough to demonstrate the fact that she has an abundance of good milk; hence, taking a wet-nurse at the end of the first or second week is always fraught with considerable uncertainty. For an infant six weeks old, a wet-nurse whose milk is anywhere between one and five months old will usually answer perfectly well. For an infant only two or three weeks old, the milk should not be more than six weeks old.

A good nurse must, first of all, be a healthy woman, free from syphilitic or tuberculous taint, and her throat, teeth, skin, glands, hair, and legs should be carefully inspected. She must have a good glandular development. Not much is to be expected of small flat breasts. The breasts must be full and hard three hours after nursing. They may be very large and yet supply very little milk, being composed almost entirely of fat. On the other hand, some smaller breasts may be almost all glandular tissue. The difference in the size of a breast before and after nursing, is one of the best guides to the amount of milk it is secreting. The nipples should be free from erosions or fissures, and long enough for the needs of the child. The nurse should not be anæmic, since it is impossible for a pale, anæmic woman to furnish good milk. Preferably she should be of a phlegmatic temperament, and of a good moral character.

This is desirable for personal reasons, although there is no evidence of moral qualities being transmitted through the milk. It is desirable that a nurse should be between twenty and thirty years of age, although much more depends upon the individual than upon the age. Other things being equal, a primipara should be chosen. The best evidence to be obtained of the character of a woman's milk is the condition of her own child; hence, if possible, it should be examined before she is accepted. It often happens that a woman who has had an abundant supply of milk for her own infant, has very little for another infant for the first few days in her new surroundings. This is usually the result of the nervous influences connected with parting from her own child, going to a new place, being carefully watched, etc. In such a case it should not be too readily decided that she is incompetent as a nurse, for, under most circumstances, with proper treatment her normal flow of milk will be re-established.

III. WEANING.—Weaning should always be done gradually, when possible, for the sake of both mother and child. Sudden weaning is apt to be followed by an attack of acute indigestion. This, however, is not an invariable result, and usually depends upon the fact that the child is given cow's milk with insufficient dilution. Weaning in hot weather is usually to be avoided, but the harm from this is not nearly so great as sometimes results where lactation is unduly prolonged because of a prejudice against a change of food at this time. While there are many women of the lower classes who are able to nurse their children to advantage for the entire first year, the number of such among the better classes is certainly very small. By the latter, nursing can rarely be continued beyond the ninth, and often not beyond the sixth month, without unduly draining the vitality of the mother and at the same time harming the child. The late months of lactation, like the early months, require close watching. It is a common mistake to continue both maternal and wet-nursing too long, owing to a dislike of making a change when things are going tolerably. It is a safe rule to make the ninth month the time to supplement the breast-feeding by other food. But here, as in the early months, the child's weight is the best guide. In the absence of evident signs of disease, a stationary weight for several weeks makes weaning advisable; a steady loss makes it imperative.

The accompanying weight-chart from a private patient (see Fig. 30) illustrates this point. The infant was nursed by the mother, and did unusually well until the sixth month. As it did not seem ill, the parents were not disturbed by the gradual loss in weight, and I was not consulted until the loss had reached three pounds. Feeding was at once begun, and in a week all nursing was stopped and the child gradually regained its lost weight. It was subsequently discovered that the mother was pregnant at the time the loss was going on.

When a nursing infant has been accustomed from birth to take either milk or simply water from a bottle once a day, as is the practice of many physicians to order, gradual weaning is generally an easy matter. Otherwise it is sometimes an impossibility, the child refusing all food except the breast so long as this is given, and nothing but starvation inducing it to take food either from a bottle or a spoon. Infants will sometimes refuse food until so weak as to make their condition serious.

Sudden weaning may be required at any time from the development in the mother of acute disease of a serious nature, such as typhoid fever or pneumonia, grave chronic disease, such as tuberculosis or nephritis, from the intercurrence of pregnancy, or from disease of the mammary gland. On no account should an infant be suckled at a breast which is the seat of acute inflammation. Through many of the minor ills—mild attacks of bronchitis, pharyngitis, indigestion, and even malarial fever—mothers will frequently nurse their children without any seeming detriment to them or themselves. In acute illness of short duration, even if severe, it is usually better, unless we decide to wean altogether, to maintain the flow of milk by the use of the breast-pump rather than allow it to dry up. The breasts may be pumped three or four times a day.

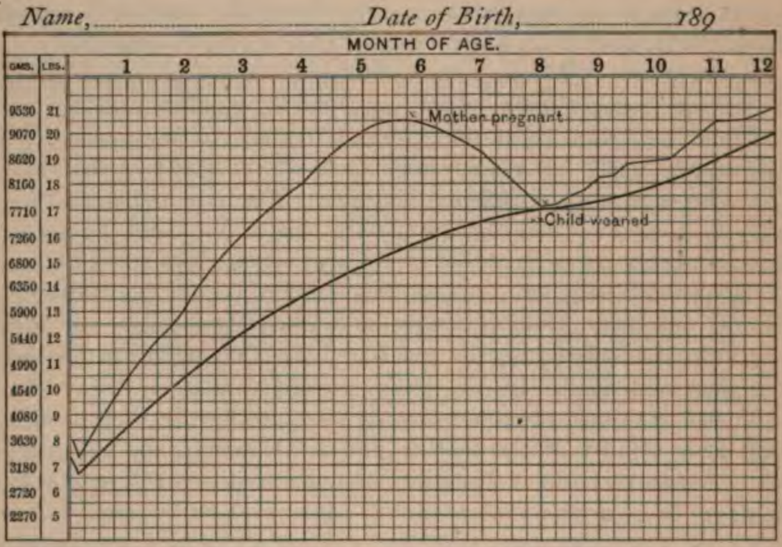


Fig. 30.—Chart showing the effect of pregnancy upon the weight of a nursing infant. The upper line is that of the patient; the lower one is the average line for the first year.

In cases of sudden weaning, the food must in the beginning be very much weaker than for an artificially-fed child of the same age. If weaned at six months, the child should be put upon a food appropriate for a healthy child of one month; if at nine or ten months, upon a food appropriate for one of three or four months. If this is done, the change can be made without causing much disturbance. When the infant has become somewhat accustomed to cow's milk the strength of the food may be gradually increased.

MIXED FEEDING.

By mixed feeding is meant a combination of breast- and artificial feeding. This may be resorted to in any case in which the milk-supply of the mother is insufficient, or when the drain upon her health is unduly great. In most cases it is better than entire artificial feeding, and there is no objection to combining the two; but before allowing a mother partly to nurse and partly to feed her infant, one must be sure that the quality of the milk is good. This is to be determined by the principles given in the preceding pages.

It is well from the very outset to accustom the infant to take one of its feedings, or at least to take water, from a bottle each day. In maternal nursing, the occasional feeding which is usually necessary, becomes then an easy matter. If circumstances make it desirable to relieve the mother of night-nursing, or of one or more feedings during the day, this also can be accomplished without difficulty. If the child is being wet-nursed, the same plan is advisable, for it then becomes easy to put an infant upon the bottle entirely in the event of the wet-nurse leaving suddenly—a not uncommon occurrence. If at any time the mother's health begins to suffer, she should be relieved of two or more nursings a day, and the bottle substituted. In this way she may be able to continue lactation for some time longer. When, however, the nursings have been reduced to only two or three daily, the milk should be examined frequently, as it is apt to deteriorate rapidly in quality. Mixed feeding is also necessary in many cases during the first few weeks, while the mother's milk is insufficient in consequence of anything which has retarded convalescence after parturition. It often happens that the milk becomes abundant and of good quality when the mother is well enough to be up and out of doors, although it was previously scanty and of inferior quality. Two or three feedings a day from the bottle, help to bridge over this period and prevent the child's nutrition from suffering. In all cases of mixed feeding, the food should be the same as when the child is fed exclusively.

ARTIFICIAL FEEDING.

There are several fundamental principles which must be constantly borne in mind:

1. The food must contain the same constituents as woman's milk, viz., fat, proteids, carbohydrates, inorganic salts, and water.
2. These constituents must be present in about the same proportion as in good woman's milk.

3. As nearly as possible the different constituents should resemble those of woman's milk both in their chemical composition and in their behaviour to the digestive fluids.

4. The addition to the food of very young infants of substances not present in woman's milk (e. g., starch) is unnecessary, contrary to the best physiology, and, if used in any considerable quantity, may be positively harmful.

In the artificial feeding of infants, cow's milk is selected, as it furnishes all the necessary elements, although not in the proportions required by young infants. In adapting cow's milk to infant-feeding, it is necessary, first, to know the differences in the composition of cow's milk and woman's milk; and, secondly, to devise the simplest means of overcoming these differences, in order to secure an infant-food which closely resembles average woman's milk in its percentages of fat, sugar, proteids, and salts. But this is not all. We can not feed all infants exactly alike, even though they are of the same age and weight. Their food must be adapted to their powers of digestion. In breast-feeding it has long been a matter of common observation that an infant might thrive perfectly on the milk of one woman, and suffer immediately from indigestion when put upon that of another, although both were equally healthy. In the selection of a wet-nurse it has sometimes been necessary to try a dozen before one could be found whose milk agreed with the infant, or, in other words, whose milk contained the different ingredients—fat, sugar, and proteids—in proportions exactly suited to the child's condition. Hence it is necessary to vary the proportions of the different constituents in order to meet exactly the requirements of the individual infant. If cow's milk disagrees with an infant, the proper method of procedure is to try and discover which of the elements of cow's milk is causing the disturbance, and to change the proportions until we have a milk which the child can easily digest. Reduced to its lowest terms, the problem of infant-feeding consists, first, in obtaining the elements of the food separately; and, secondly, in so combining them as to meet the needs of the case in hand. For this simplification of the problem the world is indebted to Rotch.

In feeding infants according to this plan, it is necessary to have a method of expressing in exact terms the composition of the food used. This can be done only by giving the percentages of the fat, sugar, proteids, and salts which the milk contains. The mere statement of the amount of milk or cream used conveys no definite idea, as these differ so much in their composition. Only by stating percentages can we record our own experience or compare our results with those of others. This new nomenclature, although perhaps a little difficult at first, is easily mastered, and is absolutely necessary in scientific infant-feeding.

THE MODIFICATION OF COW'S MILK FOR HEALTHY INFANTS DURING THE FIRST YEAR.—In modifying cow's milk for infant-feeding, our calculations are based upon the composition of good breast-milk, as determined by the latest analyses:

	Woman's milk, average.	Cow's milk, average.
	Per cent.	Per cent.
Fat	4·00	3·50
Sugar	7·00	4·30
Proteids	1·50	4·00
Salts	0·20	0·70
Water	87·30	87·50
	100·00	100·00

We have, therefore, in cow's milk, an excess of proteids and salts, too little sugar, and of fat about the quantity required. Other conditions which must be considered are the presence of bacteria in cow's milk, its acid reaction, and the fact that its proteids are more difficult of digestion. The same is probably true of the fat in the condition in which we feed it, but to a much less degree.

Fat.—The average amount of the fat of cow's milk which a healthy infant can digest varies from 2 to 4 per cent. It is rarely necessary in health to go either above or below these proportions. Beginning with 2 per cent in the early days of life, the amount may be increased to 3 per cent at one month, and to 4 per cent at five or six months. No other modification in the fat is necessary.

Sugar.—In woman's milk the percentage of sugar is remarkably constant under all conditions—between 6 and 7 per cent. In feeding cow's milk it is seldom required to have the sugar less than 5 and never more than 7 per cent. This is the simplest part of the modification. As the sugar in milk is simply lactose in solution, it is only necessary to calculate the amount required to be added to bring this up to the 6 or 7 per cent desired. The milk sugar should be first dissolved in boiling water, and, when it contains impurities, filtered through absorbent cotton. It should be prepared at least every second day, and in summer daily. It is more rational in theory, and certainly better in practice, to use milk sugar rather than cane sugar, since the former supplies what exists in woman's milk. It should be distinctly understood that the purpose of adding sugar to milk is not to sweeten the food, but to furnish the proper proportion of a soluble carbohydrate necessary for the infant's nutrition. When, however, good milk sugar can not be obtained, cane sugar may be substituted; the amount added must be but little more than half that of milk sugar on account of its sweeter taste, and greater liability to ferment in the stomach.

Proteids.—The modification of the proteids is the most important change necessary in cow's milk, for it is the proteids which give most of the trouble to the infant digestion. In ordinary cases in health, a reduction in the amount is all that is necessary. But for very young infants it is not enough to reduce the proteids to the proportion present in average woman's milk—1·5 per cent. In the beginning, and even during the first months, we must go considerably below this point, usually to 1 per cent, and for the first few weeks to 0·75 or even 0·50 per cent. The secret of success in feeding cow's milk, is to reduce the proteids at the start to a proportion which the infant can easily digest, and then gradually increase the amount. By the end of the first month the average child can take 1 per cent, by the fourth month 1·5 per cent, and by the sixth month 2 per cent.

This reduction in the proteids is effected by dilution with water. In the following table is shown the result of various dilutions upon the proteids and inorganic salts:

	Cow's milk.	Diluted once.	Diluted twice.	Diluted three times.	Diluted four times.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Proteids........	4·00	2·00	1·33	1·00	0·80
Salts............	0·70	0·35	0·23	0·18	0·14

Inorganic Salts.—These, like the proteids, are excessive in cow's milk, and nearly to the same degree. When, therefore, milk is diluted as required by the proteids, the salts will be nearly in their proper proportion, and they may be dismissed from separate consideration.

Reaction.—The acidity of cow's milk may be overcome by the addition either of lime water or bicarbonate of soda. Of the former there is required about one ounce to each twenty ounces of the food; of the latter, about one grain to each ounce of the food.

The subject of heating milk for the destruction of bacteria has been considered in a previous chapter (page 143).

Milk Laboratories.—There have been established in Boston, New York, and other cities, laboratories which undertake to furnish "modified milk" of any desired proportions, upon the prescription of physicians, exactly as drugs are dispensed by an apothecary. The elements used by these laboratories are: (1) cream containing 16 per cent fat; (2) separated milk from which the fat has been removed by the centrifugal machine; (3) a standard solution of milk sugar, 20 per cent strength. These contain fat, sugar, and proteids in the following proportions:

	Cream.	Separated milk.	Sugar solution.
	Per cent.	Per cent.	Per cent.
Fat..........................	16·00	0·13	....
Sugar........................	4·00	4·40	20·00
Proteids.....................	3·60	4·00	....

By combining these it is possible to vary the percentages of fat, sugar, and proteids in the milk to almost any degree desired, and to do this with very great accuracy. At the present time a separate modification of the inorganic salts is not attempted. The physician, in ordering the food, simply writes for the percentages of fat, sugar, and proteids desired, with the number of feedings for twenty-four hours and the quantity for each feeding. The food-supply for an entire day is delivered each morning in the bottles from which it is to be fed. The laboratory also undertakes to heat milk to any temperature that may be desired. The following is the form in which prescriptions are written:

℞ Fat	3 per cent.
Sugar	6 "
Proteids	1 "
Alkalinity, limewater	5 per cent.
Number of feedings	8
Amount for each feeding	4 ounces.

Heat to 167° F., 25 minutes.

The establishment of the milk laboratory, for which the profession is indebted to Rotch, is a great stride in advance in infant-feeding, as it enables the physician to know what his patient is taking, at the same time making it possible to vary any one of the constituents of the food separately, even to a fraction of one per cent, until the combination is reached which is exactly suited to the infant's digestion. With the assistance of the milk laboratory, infant-feeding can be done with something like scientific accuracy. The laboratory company has the direct oversight of the breeding, care, and food of cows and the handling of milk, to insure its purity, freshness, and cleanliness. The practical workings of the milk laboratories are so satisfactory that we shall doubtless see them established in all large cities. The only drawback is the expense.

After three years' experience I have found the laboratory of great value in difficult cases of infant-feeding, and it soon becomes almost as much of a necessity to the physician practising among young children, as does the apothecary shop to the general practitioner.*

As a general guide to the modification of milk for an average infant the following table is introduced, showing the changes required with the age of the child:

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* For fuller details regarding the milk laboratory, see Rotch, Archives of Pædiatrics, February, 1893.

Schedule for feeding an average healthy infant from birth upon modified cow's milk, showing percentages of fat, sugar, and proteids, and the daily quantity.

No.	Age.	Fat.	Sugar.	Proteids.	Daily quantity.	
		Per cent.	Per cent.	Per cent.	Ounces.	Grammes.
I	First and second day	...	5·0	....	4– 8	125– 250
II	Third to fourteenth day	2·0	6·0	0·60	10–15	310– 460
III	Two to four weeks	2·5	6·0	0·80	20–30	620– 930
IV	One to three months	3·0	6·0	1·00	22–36	680–1,110
V	Three to five months	3·5	6·0	1·25	28–38	870–1,180
VI	Five to six months	4·0	7·0	1·50	32–38	990–1,180
VII	Six to nine months	4·0	7·0	2·00	34–42	1,050–1,300
VIII	Nine to twelve months	4·0	6·0	2·50	38–45	1,180–1,400
IX	Twelve to fifteen months	4·0	5·0	3·00	40–50	1,240–1,550
X	Fifteen to eighteen months	4·0	5·0	3·50	45–50	1,400–1,550
XI	Eighteen months (whole milk)	3·5	4·3	4·00	45–50	1,400–1,550

In ordering milk for an infant, not only its age but its weight must be taken into account. One that at four months weighs as much as the average child at eight months, will usually be found able to take the quantity of food and also the percentages advised for the latter age. Again, there are many cases where the percentages of the milk must be increased more slowly than in the schedule. As a rule, it is wise to increase the strength of the food just as fast as the child's digestion will permit.

Modification of Milk at Home.—Inasmuch as milk laboratories are as yet accessible to but very few physicians, the problem presented is how to secure similar results by simple methods when milk is "modified" at home. If directions are followed, results may be obtained sufficiently accurate for practical purposes in the great majority of cases. However, considerable care and intelligence are necessary.

The elements with which the formulæ desired are most conveniently obtained are: (1) a 12-per-cent cream—i. e., one that contains 12 per cent fat; (2) an 8-per-cent cream; (3) solutions of milk sugar of 5, 6, 7, 8, and 10 per cent strength.

The 12-per-cent cream may be obtained in the city by using equal parts of ordinary (20 per cent) centrifugal cream and plain milk; in the country, by using two parts of ordinary skimmed or gravity (16 per cent) cream* and one part of plain milk; or by taking the upper fifth of the milk after standing five or six hours, in the manner described on page 142.

The 8-per-cent cream may be obtained in the city by using one part of centrifugal (20 per cent) cream and three parts of plain milk; in the country, by using one part of gravity cream and two parts of plain milk;

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* This is the ordinary cream twelve hours old. It should be set at night and used in the morning.

or by using the upper third of the milk after standing five or six hours, as described on page 142.

The sugar solutions are obtained as follows :

A 5-per-cent solution : Dissolve an ounce of milk sugar[*] in twenty ounces of water, or one even tablespoonful[†] in seven and a half ounces of water.

A 6-per-cent solution : Dissolve one ounce of sugar in sixteen and a half ounces of water, or one even tablespoonful in six and a half ounces of water.

A 7-per-cent solution : Dissolve one ounce of sugar in fourteen ounces of water, or one even tablespoonful in five and a half ounces of water.

An 8-per-cent solution : Dissolve one ounce of sugar in twelve and a half ounces of water, or one even tablespoonful in four and a half ounces of water.

A 10-per-cent solution : Twice the strength of a five-per-cent solution.

With these ingredients it is a comparatively easy matter to make up with approximate accuracy the various formulæ required. Formulæ II to VI inclusive may be obtained from the 12-per-cent cream by simply diluting this five, four, three, two and a half, and two times respectively with a 6- or 7-per-cent sugar solution. This will be plain from the following table :

Formulæ obtained by diluting Twelve-per-cent Cream.

Diluting	5	times[‡]	with	6%	sugar	solution	= II:	Fat	2·0%;	sugar,	6%;	proteids,	0·60%.
"	4	"	"	6%	"	"	= III:	"	2·5%;	"	6%;	"	0·80%.
"	3	"	"	7%	"	"	= IV:	"	3·0%;	"	6%;	"	1·00%.
"	2½	"	"	7%	"	"	= V:	"	3·5%;	"	6%;	"	1·20%.
"	2	"	"	7%	"	"	= VI:	"	4·0%;	"	6%;	"	1·30%.

In all these formulæ it will be seen that the ratio of the fat to the proteids is three to one. Not only these formulæ, but any intermediate ones with this ratio, may be derived by varying the dilution. The sugar may be easily modified, if desired, by using weaker or stronger solutions than those mentioned. With these formulæ an average infant may be carried through the first six months, the period when accurate modification is most needed.

Formula VII is obtained from an 8-per-cent cream by diluting once with a 10-per-cent sugar solution ; and in a similar way are derived other formulæ in which the fat and the proteids bear the relation of two to one :

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[*] A convenient method is, to obtain from a druggist a box holding exactly one ounce of milk sugar.

[†] One even tablespoonful may be calculated as three drachms.

[‡] By diluting five times is meant one part of the cream and five parts of the sugar solution, etc.

Formulæ obtained by diluting Eight-per-cent Cream.

Diluting	once	with	10%	sugar solution	= VII:	Fat, 4%;	sugar, 7%;	proteids, 2·00%.
"	1½ times	"	7%	" "	= XII:	" 3%;	" 6%;	" 1·50%.
"	3 times	"	7%	" "	= XIII:	" 2%;	" 6%;	" 1·00%.
"	7 "	"	5%	" "	= XIV:	" 1%;	" 5%;	" 0·50%.

It is in many cases desirable to use a lower percentage of fat than in the foregoing formulæ without reducing the proteids. This may be done simply by diluting plain milk with a sugar solution. In these formulæ the fat and proteids are nearly in the same proportions, viz.:

Formulæ obtained by diluting Plain Milk.

Diluting	once	with	8%	sugar solution	= XV:	Fat, 1·80%;	sugar, 6%;	proteids, 2·00%.
"	3 times	"	5%	" "	= XVI:	" 0·90%;	" 5%;	" 1·00%.
"	7 "	"	4%	" "	= XVII:	" 0·45%;	" 4%;	" 0·50%.
"	11 "	"	4%	" "	= XVIII:	" 0·30%;	" 4%;	" 0·34%.

From the three fundamental formulæ—12-per-cent cream, 8-per-cent cream, and plain milk—we may readily derive almost any desired formula in which the proportion of fat is to that of the proteids as three to one, two to one, or where they are about equal.

Following out the directions given in the preceding pages, the preparation of an infant's milk should be somewhat as follows: The first thing to be decided is the formula to be used, then the size of each feeding and the number of feedings; as it is always preferable to prepare at one time the entire amount of food required for twenty-four hours. Let us suppose we wish to give a milk containing fat 3 per cent, sugar 6 per cent, and proteids 1 per cent (formula IV), and that we require nine feedings of four ounces, or thirty-six ounces of food to be prepared. By referring to page 175 we see that this formula can readily be obtained by diluting a 12-per-cent cream three times with a 7-per-cent sugar solution. There will thus be required, nine ounces of the 12-per-cent cream and twenty-seven ounces of the 7-per-cent sugar solution. The cream may be obtained by taking four and a half ounces of centrifugal (20 per cent) cream and four and a half ounces of milk, or six ounces of skimmed (16 per cent) cream and three ounces of milk. For the sugar solution there will be required two ounces, or five and a half even tablespoonfuls, of milk sugar, to be dissolved in the twenty-seven ounces of boiling water; or, if limewater is to be added, one and a half ounces of limewater and twenty-five and a half ounces of boiling water. The full directions, written out for the guidance of a nurse, will then be as follows:

Centrifugal cream,	4½ ounces,	or	skimmed cream,	6 ounces.
Plain milk,	4½ "		plain milk,	3 "
Milk sugar,	2 "	or	5½ even tablespoonfuls.	
Boiling water,	25½ "	or	boiling water,	27 ounces.
Limewater,	1½ ounce,		bicarbonate of soda,	36 grains.

Dissolve the milk sugar in the boiling water, filter through cotton, add the milk and cream, and mix all in a pitcher; then add limewater or soda, and divide in nine bottles, stopping them with cotton.

If the milk is to be heated for purposes of sterilization, directions for this should follow; if not, the bottles should be rapidly cooled by standing in cold water for fifteen minutes, during which the water should be changed once or twice, or kept cold by adding ice. The food should now be placed in an ice-chest, where it is kept until required. It should be warmed by placing the bottle in warm water, and shaken before it is fed.

Although at first glance the preparation of food in the manner indicated may seem too complicated for general use, such is really not the case. The labour involved is not greater than when milk is prepared in a more irregular way, and any intelligent mother or nurse is fully competent to carry out all the directions given when once they have been fully explained.

To save the physician the trouble of calculating the exact quantity of each of the ingredients required for the formulæ most used—viz., II, IV, and VII—there are given in the subjoined table the amounts needed for the preparation of twenty-four, thirty-two, forty, and forty-eight ounces respectively of food:

No.	Formula.	Ingredients.	QUANTITY OF EACH INGREDIENT REQUIRED TO PREPARE THE FOLLOWING AMOUNTS OF FOOD.			
			24 oz.	32 oz.	40 oz.	48 oz.
II.	Fat, 2·0%	Milk	1½ oz.	1¾ oz.	2¼ oz.	2¾ oz.
	Sugar, 6·0%	Cream (skimmed, 16%)	2½ “	3½ “	4¼ “	5¼ “
	Proteids, 0·6%	Water	20 “	26⅔ “	33½ “	40 “
		Milk sugar, ounces	1⅕ “	1⅗ “	2 “	2⅖ “
		Or milk sugar, even tablespoonfuls	3 “	4 “	5½ “	6½ “
IV.	Fat, 3·0%	Milk	2 “	2⅔ “	3⅓ “	4 “
	Sugar, 6·0%	Cream (skimmed, 16%)	4 “	5⅓ “	6⅔ “	8 “
	Proteids, 1·0%	Water	18 “	24 “	30 “	36 “
		Milk sugar, ounces	1⅕ “	1⅗ “	2 “	2⅖ “
		Or milk sugar, even tablespoonfuls	3 “	4 “	5½ “	6½ “
VII.	Fat, 4·0%	Milk	8 “	10⅔ “	13⅓ “	16 “
	Sugar, 7·0%	Cream (skimmed, 16%)	4 “	5⅓ “	6⅔ “	8 “
	Proteids, 2·0%	Water	12 “	16 “	20 “	24 “
		Milk sugar, ounces	1⅕ “	1⅗ “	2 “	2⅖ “
		Or milk sugar, even tablespoonfuls	3 “	4 “	5½ “	6½ “

If the centrifugal (20 per cent) cream is used, equal parts of milk and cream should be taken for formulæ II and IV; while for formula VII the proportions should be one-fourth cream and three-fourths milk. When limewater is to be added, it should replace the same quantity of plain water. The same is true of barley water, if used with formula VII, as is sometimes desirable.

For older infants, able to take a stronger milk than formula VII, proportions similar to formula VIII (p. 174) may be obtained, thus:

Milk, 24 oz.; cream (16%), 7 oz.; water, 19 oz.; sugar, 2 oz. = 50 oz.

Bottles and nipples.—The best style of bottle is that which can be most readily cleaned. The cylindrical bottles with wide mouths are now generally preferred. Some trouble in measuring the food is avoided if graduated bottles are used. On no account should bottles with any complicated apparatus be allowed. The best nipples are those of plain black rubber, which slip over the neck of the bottle. Those with a long rubber tube going to the bottom of the bottle should not be used, as it is practically impossible to keep them clean. The hole in the nipple should be large enough for the milk to drop rapidly when the bottle is inverted, but not so large that it will run in a stream. When not in use, nipples should be kept in a solution of borax or boric acid. The most scrupulous care is necessary of both bottles and nipples. Bottles should first be rinsed with cold water, then washed with hot soap suds and a bottle-brush. When not in use they should stand full of water. Before the milk is put into them they should be sterilized by lying for twenty minutes in boiling water.

Rules for artificial feeding.—A bottle should not be warmed over for a second feeding. A child should not be more than twenty minutes in taking its food, and should not be allowed to sleep with the nipple of the bottle in its mouth. It is preferable to have the child held in the arms of the nurse while taking its bottle. If this is not done, the bottle should at least be held in such a position that the child gets milk, and not air, from the bottle. It is even more necessary than in breast-feeding that rules as to frequency and regularity of meals should be observed. The following table gives the size of the meals, and the daily quantity of food, as well as the number of meals and intervals of feeding. This is constructed for an average infant in health. An infant much above the average in weight must usually have its food graded accordingly.

Schedule for Feeding Healthy Infants during the First Year.

AGE.	No. of feedings, 24 hours.	Interval between meals, by day.	Night feedings (10 P. M. to 7 A. M.).	Quantity for one feeding.		Quantity for 24 hours.	
		Hours.		Ounces.	Grammes.	Ounces.	Grammes.
3d to 7th day	10	2	2	1 -1½	30- 45	10-15	310- 460
2d and 3d weeks	10	2	2	1½-3	45- 90	15-30	460- 930
4th and 5th weeks	9	2	1	2½-3½	75-110	22-32	680- 990
6th week to 3d month	8	2½	1	3 -4½	90-140	24-36	740-1,110
3d to 5th month	7	3	1	4 -5½	125-170	28-38	870-1,080
5th to 9th month	6	3	0	5½-7	170-220	33-42	1,020-1,300
9th to 12th month	5	3½	0	7½-9	235-280	37-45	1,150-1,400

Modification of Milk required by Particular Symptoms.—Regarding the exact indications according to which the fat, sugar, and proteids of milk are to be varied in infant-feeding, much is yet to be learned. The following are the points which experience has thus far led me to depend upon:

If the sugar is too low, the gain in weight is apt to be slower than when it is furnished in proper amount. The symptoms most frequently indicating an excess of sugar are colic, or thin, green, very acid stools, sometimes causing irritation of the buttocks. In some cases, where the sugar is in excess, there is much eructation of gas from the stomach, and regurgitation of small quantities of food.

An excess of fat is indicated by vomiting or the regurgitation of food in small quantities, usually one or two hours after feeding. It is sometimes shown by frequent passages from the bowels, which are nearly normal in appearance. In some cases the stools contain small round lumps somewhat resembling casein, but really composed of masses of fat. In rare cases an excess of fat may be the cause of colic. The most constant indication that too little fat is given, is constipation with dry, hard stools; but it should not be forgotten that such stools are sometimes seen when the fat is not too low. To increase the fat above 4 per cent in feeding infants under six months old, simply because of constipation, is, I think, a mistake. I have rarely seen any advantage and often much disturbance from higher fats.

The most reliable indication that the proteids are in excess is the presence of curds in the stools. This condition is also a frequent cause of colic—indeed, of most of the colic of early infancy. Sometimes there is diarrhœa, but more frequently there is constipation, especially when the excess of proteids is great. This condition may be the cause of vomiting or the regurgitation of small quantities of food from time to time. Imperfect digestion of the proteids may cause the same symptoms as when they are in excess, and the same may be true of the fat and of the sugar. Often the difficulty may be, not that the proportion of the different elements of the food is actually in excess, but that more is given than the infant can digest at the time, and in any event the amount should be reduced.

It is not practicable, even were it possible, to modify the milk so as to meet every temporary symptom of discomfort an infant may have. In general the most important indications may be summarized as follows: if not gaining in weight without special signs of indigestion, increase the proportions of all the ingredients; if habitual colic, diminish the proteids; for frequent vomiting soon after feeding, reduce the quantity; for the regurgitation of sour masses of food, reduce the fat, and sometimes also the proteids; for obstinate constipation, increase both fat and proteids.

THE USE OF OTHER FOOD THAN MILK DURING THE FIRST YEAR.—In the discussion up to this point, nothing but the elements of milk has been considered. Upon these alone the infant can best be nourished during the greater part of the first year. The addition of other food should usually be deferred until the eighth or ninth month. At this period the power of digesting starch is sufficiently strong for the infant to receive some of its carbohydrates in this form, instead of all of it in the form of sugar, as has been previously the case. As starch is added, the sugar should be gradually reduced. The form of starch used may be a gruel made of barley, oatmeal, or arrowroot, or some of the farinaceous foods (page 156). If barley is used, the proper proportion to begin with, is to make the food about one third its volume of barley water of the strength mentioned on page 155. This will take the place of the same quantity of boiled water in the preparation of the food. It will then be added to each one of the feedings. By the eleventh or twelfth month the quantity of barley may be further increased by making the barley water stronger, rather than by using a larger quantity. The choice between the different cereals will depend upon the case. Where there is a tendency to constipation, oatmeal water is to be preferred; at other times barley. The only other thing to be advised during the first year is beef-juice (for preparation, see page 153). This may be begun in the tenth or eleventh month. At first only half an ounce should be given daily, either alone or added to the milk. Later the daily quantity may be increased to three ounces, given with two of the feedings.

FEEDING IN DIFFICULT CASES.—Thus far we have dwelt upon the management of the food for healthy infants of average digestion, or, in other words, normal cases. There remain to be considered the modifications required for infants with feeble digestion—the difficult cases. This group is quite a large one. Some of these are delicate children with feeble digestion from birth, a class more numerous in the city than in the country; but there is a much larger number with chronic disturbances of digestion due to previous bad methods of feeding, or, what may be just as serious, improper nursing. In other cases the condition of feeble digestion is the result of unhygienic surroundings. In still others it is the consequence of previous attacks of acute disease of the digestive organs or of some general disease, such as influenza, whooping-cough, or pneumonia. In all the problem is essentially the same,—to adapt the food to an infant whose powers of digestion and assimilation are very feeble and easily disturbed. Time, patience, a careful study of individual cases, and close attention to details are necessary to secure the best results. The general care required by these children is equally as important as their food. This, however, is considered in the chapter on Malnutrition, and only the dietetic treatment will be discussed in this connection.

The difficulties are always greatest in the early months—viz., in giving the infant a start. When this has once been done, future progress is generally easy. A food weakened to correspond to the child's power of digestion, may be able to do no more than repair the waste of the body, and sometimes not even that. The most common mistake is to use in the beginning a food so strong as to disturb the digestive organs. When once this has been done, all progress is difficult. These cases demand all our resources, and the difficulties are usually increased in proportion to the duration of the disorder. It may have existed so long that no form of artificial feeding, or even wet-nursing, will succeed. While these cases differ widely and each one must be studied by itself, there are certain principles of general application.

1. The strength and quantity of the food are better gauged by the weight than by the age of an infant, but best of all by its power of digestion. This can only be determined by careful experimentation in each individual case.

2. A larger quantity of a dilute food is usually better borne than a smaller quantity of one more concentrated.

3. Up to the third month the rules as to frequency of meals should be the same as those for healthy infants. After this time the intervals should usually be shorter.

Modification of Milk in Difficult Cases.—In the early months the usual symptoms presented by these cases are that they do not gain in weight, and that they show to a more or less marked degree the following signs of indigestion: the stools contain undigested food, usually lumps of casein; there may be diarrhœa or constipation, usually the latter; there is frequently a regurgitation of small quantities of food, sometimes actual vomiting; there are usually flatulence and colic. In consequence of the foregoing conditions, sleep is disturbed, and the infants are cross and fretful much of the time.

No proper gain in weight is to be expected until the indigestion is overcome, and this should be the first purpose in the management of such cases.

So far as the elements of milk are concerned, it should be remembered that the sugar is least likely to be a cause of trouble, and it need rarely be reduced below 5 per cent, and never below 3 per cent. It is the proteids which give the most trouble, the fat coming next. For young infants with feeble digestion the proteids should always be reduced to 1 per cent, and usually to 0·5 per cent; it may even be necessary to reduce to 0·25 per cent for a short time. The fat can usually be taken in the proportion of 1 or 2 per cent, rarely more than the latter. For a short time it may be necessary to reduce the fat below 1 per cent. The proportions to be used under these conditions may be those of formula II, page 175: fat, 2 per cent; sugar, 6 per cent; proteids, 0·6 per cent; or, if the 12-per-cent cream (page 174) is diluted with eleven parts of a 5-per-cent sugar solution, we obtain :

Formula XIX	Fat	1·00 per cent.
	Sugar	5·00 "
	Proteids	0·30 "

If we desire a relatively lower proportion of fat, we may use formula XIV (page 176): fat, 1 per cent; sugar, 5 per cent; proteids, 0·50 per cent; or, diluting the 8-per-cent cream (page 174) with fifteen parts of a 4-per-cent sugar solution (one ounce to twenty-five ounces), we obtain:

Formula XX	Fat	0·50 per cent.
	Sugar	4·00 "
	Proteids	0·25 "

Usually, then, we should begin with one of the formulæ having the low percentages mentioned, and with improvement in the symptoms gradually increase the fat and proteids by making the dilution less; if we began with formula XIX, instead of eleven parts of the sugar solution, using ten, nine, seven, five, etc.; or, in a similar way, varying formula XX. The rapidity with which these changes can be made will of course vary with the progress of the case.

For infants from four to ten months old presenting similar symptoms, a somewhat different modification must be made, particularly in cases of the marasmus type with long-standing trouble. As much difficulty may be experienced by them with the fat as with the proteids, and in some cases even more. But by most of these, as well as by the younger infants, sugar is well tolerated. We may begin with formula XVIII (page 176): fat, 0·30 per cent; sugar, 4 per cent; proteids, 0·34 per cent; after a time the strength of the food being gradually increased to formulæ XVII, XVI, and XV by diminishing the dilution of the milk. Sometimes, however, we may succeed better by beginning exactly as with younger infants, making the increase in strength usually with somewhat greater rapidity.

The Use of Peptonized Milk.—Another plan which may be followed with infants who have great trouble in digesting the proteids of cow's milk is that of peptonizing the milk. For a description of the process, see page 148. It is important that a proper formula should likewise be used in these cases. For young infants such proportions as those of formula XIII, page 176, are appropriate—fat, 2 per cent; sugar, 6 per cent; proteids, 1 per cent. In the beginning, the process may be continued for an hour; later, with improvement in the symptoms, reducing the time to half an hour, and then to fifteen and even ten minutes. It is preferable that the bottles of milk should be peptonized separately just before each feeding. The amount of the powder required is one grain of the extractum pancreatis and three grains of bicarbonate of soda to each three ounces of the milk. The partial digestion of the milk may be continued for several weeks, or until the stomach has in a measure regained its digestive power. There is a serious objection to its use for as long a period as four or five months, for in such a case the stomach gradually becomes less and less able to do its proper work. Which of the two methods of procedure—greatly reducing the amount of proteids or predigesting them—is the better one, will depend upon the individual case.

The Addition of other Substances to Milk.—The opinion has long prevailed that the addition to milk of some mucilaginous substance, such as a gruel made from barley, oatmeal, or arrowroot, or gelatine and water, facilitates the digestion of the proteids of cow's milk by preventing in the stomach the coagulation of the casein in large solid masses which are dissolved with such difficulty. The method of preparation has been to use these substances in the place of water, simply as diluents for milk, or more frequently to cook the milk with them for a short time—two to fifteen minutes—in order to obtain a more intimate combination with the casein. The substance most commonly employed has been a thin barley gruel. (For preparation, see page 155.) This may take the place of some of the plain boiled water in any of the formulæ previously given, the usual proportion being to make the food from one fourth to one half its volume of the gruel.

The recent experiments of Rotch and others throw a good deal of doubt upon the traditional belief in regard to the effect upon the casein of this treatment, and it is really questionable whether anything more is accomplished than by diluting with water. This method of preparing milk is certainly of much less value than the careful modification of the milk constituents which has been previously considered. Still, it is a method which is useful in certain cases, whether the explanation which has been offered be the correct one or not. It should, however, be remembered that the starchy substance, whatever it may be, plays but a very small part in the nutrition of the infant; first, because the amount of starch used is considerably below one per cent of the food, the other elements of the gruel being in such small proportions that they may be almost ignored; and, secondly, because of the very feeble power of transforming starch into sugar which exists in the young infant.

The Use of other Sugars than Milk Sugar.—It has been already stated that it is rare that there is difficulty in the digestion of sugar; but such is sometimes the case. It is also true that there are exceptional instances in which milk sugar is not well borne, where cane sugar or even maltose (as in some of the malted foods) may be taken. Both of these are so sweet they must be used in proportions considerably smaller than those of milk sugar, and generally as temporary substitutes only.

The addition of Beef Juice (page 153) to the milk where the digestion is so feeble as to require a great reduction in the proteids, is at times advantageous. From one half to two tablespoonfuls may be added to each feeding. Instead of beef juice, some of the beef peptonoids mentioned on page 154 may be used.

The number of cases which can not be managed by simply varying the different elements of cow's milk, is small. In private practice, if the child can be taken in hand at the outset, the number is very small, the exceptions being premature and delicate infants, which are reared under any circumstances only with the greatest difficulty. The difficulties are much increased where the disordered digestion has already lasted several weeks or months. They are greatest in institutions where many infants are brought together. As the weight is our most important guide to the success of any method of feeding, we must have accurate scales and weigh the infants twice a week, in order to determine as soon as possible what progress is made, so that a useless experiment may not be unduly prolonged. For the first week or two no more than an arrest of the previous loss in weight is to be expected. There can be no material gain until the symptoms of indigestion, colic, bad stools, restlessness, and vomiting are greatly lessened or entirely gone. Until this is the case the food can not be increased in strength. The gain is almost always slow at first, amounting perhaps only to two or three ounces a week; but it should be steady. Later, under favourable conditions, it should increase to six or eight ounces, or even more.

For those children who do not thrive with an intelligent modification of cow's milk according to the plan above outlined, the thing most likely to succeed is the employment of a wet-nurse, although if the condition of malnutrition has become firmly established even this often fails. Sometimes condensed milk succeeds, although its composition after dilution (page 149) is similar to that which we have been employing (formula XVII or XVIII, page 176), the chief difference being the substitution of cane sugar for the milk sugar. In rare cases infants seem unable to digest raw milk, but improve when put upon milk that has been sterilized. Sometimes there is an advantage in withholding for a short time all milk constituents, and giving one of the malted foods with water, or animal broths. In apparently hopeless cases the most unpromising food or combination may occasionally succeed. I have lately seen an infant thrive upon plain milk undiluted, where all scientific modifications and additions had failed utterly. In every instance the general principle must be to begin with something which the child can digest and assimilate, and return to the usual proportions of the milk ingredients gradually, but just as soon as possible. We must often begin by doing what we can, not what we would like to do. We must avoid the danger of keeping an infant for a long time upon completely peptonized milk, also upon milk containing very low percentages of fat and proteids, like some of those referred to, and the continuance of food composed almost entirely of carbohydrates where all milk has been withdrawn.

ast (6 to 7 a. m.).—1. A glass of milk with stale bread
a it, or one of the numerous good breakfast foods on the
2. Oatmeal, arrowroot, wheaten grits, farina, hominy
c., made into a porridge and well cooked, and with the
ture in use poured over it. 3. A soft-boiled or poached egg
ken bread in it, and a glass of milk.
Meal (10 a. m.).—A glass of milk.

(1:30 to 2 p. m.).—1. Bread moistened with dish gravy
beef tea or beef juice; a glass of milk. 2. Rice or grits
d in the same way; a glass of milk. 3. A soft-boiled egg
bread thinly buttered; a glass of milk. Rice, sago or
udding or junket, in small quantities as dessert with any
diets.
Meal (5 p. m.).—A glass of milk or some bread and milk.
Meal (9 to 10 p. m.).—A glass of milk.

DIET FROM 18 MONTHS TO 2 YEARS.

ast (7 a. m.).—1. A glass of milk with a slice of bread
er or a soda, graham, oatmeal or similar unsweetened
2. A soft-boiled egg with bread and butter and a glass
3. Porridge, as described in the previous list.
Meal (10 a. m.).—1. Bread broken in milk. 2. Bread and
a soda or other biscuit with a glass of milk.
(2 p. m.).—1. Boiled rice or a baked potato, mashed and
d with dish gravy or beef juice; a glass of milk. 2. Mut-
icken broth with barley rice in it; some bread and butter,
e sago or rice pudding made with milk. 3. A small por-
inced white meat of chicken or turkey, or rare roast beef,
, lamb, mutton or fish; bread and butter; a glass of milk.
meal (5 p. m.).—1. Bread and milk. 2. Bread and but-
a glass of milk.

DIET FROM 2 TO 3 YEARS.

fast (7 to 8 a. m.).—1. A small portion of beefsteak, with
hominy grits, wheaten grits, cornmeal or other cereal
with plenty of milk. 2. A soft-boiled egg, bread and but-
a glass of milk.
Meal (11 a. m.).—1. A glass of milk with bread and but-
ith a soda or other biscuit. 2. Bread and milk. 3. Chicken
n broth.
r (2 p. m.).—Roasted fowl, mutton or beef cut fine; mashed
otato with butter or dish gravy on it; bread and butter,
rt, tapioca, sago or rice pudding, junket or a small quantity
erries, peaches, grapes without seeds, orange juice or of
pples or prunes.
r (6 p. m.).—1. Bread and butter. 2. Milk with soda or
biscuit or with bread and butter.

DIET AFTER THREE YEARS.

FOODS PERMITTED.

.—Broiled beefsteak, lamb chops and chicken; broiled liver;
or boiled beef, mutton, lamb, chicken and turkey; broiled
d fish; raw or stewed oysters.
—Soft-boiled, poached, scrambled, omelet.
s.—Light and not too fresh wheaten and graham bread,
wieback; plain unsweetened biscuit, as oatmeal, graham,
ater, etc.; hominy grits, wheaten grits, cornmeal, barley,
meal, macaroni, etc.
—Plain soup and broth of nearly any kind.
ables.—White potatoes, boiled onions, spinach, peas, aspara-
pt the hard parts, string and other beans, salsify, lettuce,
celery, young beets, arrowroot, tapioca, sago, etc.
.—Nearly all if stewed and sweetened; of raw fruits,
are one of the best; pears, well-ripened and fresh rasp-
strawberries, blackberries, grapes without the skin and
ranges.
rts.—Light puddings, as rice pudding without raisins,
uddings, etc., plain custards, wine jelly, ice cream, junket.

FOODS TO BE TAKEN WITH CAUTION.

y, muffins, hot rolls, sweet potatoes, baked beans, squash,
parsnips, carrots, egg-plant, stewed tomatoes, green corn,
plums, apples, huckleberries, gooseberries, currants.

FOODS TO BE AVOIDED.

food of any kind; griddle cakes; pork; sausage, highly-
food; pastry; all heavy, doughy or very sweet puddings;
our or wilted fruit; bananas, pineapples, cucumbers, raw
w tomatoes, cabbage, cauliflower, nuts, [illegible] reserved
ms, tea, coffee, alcoholic beverages.

RST YEAR.

SECOND YEAR.

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" 4·0% (i. e., plain milk).

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skin gradually faded but had not entirely disappeared
he was discharged, on the twelfth day. No special treat
was instituted except an ice bag to the chest and, s
quently, adhesive strips, with enough morphin to relieve
pain. Microscopic examination of a piece of skin rem
from the side of the neck showed practically no alterat
The capillaries here and there were more or less dist
with blood, but no blood was found anywhere in the
sues outside of the blood vessels.

Medical Record, New York.

February 4.

21 *Sanitary Conditions as Encountered in Cuba and Pa
and What Is Being Done to Render the Canal Zone He
William C. Gorgas, U. S. A.
22 *Intramuscular Hemorrhage from Muscular Action. A
H. Smith, New York.
23 Review of Some Recent Papers on the Surgical Treatm
Prostatic Hypertrophy. E. G. Ballenger, Atlanta, Ga.
24 *Diagnosis of Renal and Ureteral Calculi. H. A. F
Washington, D. C.
25 *Growth of Bone in the Tonsil. William W. Carter, New
26 *Report of Three Cases of Intestinal Anastomosis by the
nell Suture. H. H. Sinclair, Walkerton, Ont.

21. **Sanitary Conditions in Cuba and Panama.**—Gorgas
cusses the progress and results of sanitary measures in C
particularly with reference to the extermination of ye
fever, and outlines the steps that will be taken to re
the Isthmian Canal zone as free from malaria and ye
fever as is Havana.

22. **Intramuscular Hemorrhage from Muscular Actio**
Smith emphasizes the distinction to be drawn between t
cases in which the escape of blood within the intact sh
of a muscle is the important factor and those in which
eration of muscle and sheath plays the principal part.
says the former variety may give rise to greater imme
suffering and to more lasting impairment of function
the latter. Rupture of individual muscle fibrillæ, the
of a violent contraction, is comparatively common, even
healthy muscle. Almost any muscle may be involved,
those that act through tendon of achilles suffer most
cause of the greater strain to which they are subje
Other causes of rupture are excessive stimulation, irreg
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CHAPTER IV.

FEEDING AFTER THE FIRST YEAR.

HEALTHY INFANTS DURING THE SECOND YEAR.

THE physician should not relax his vigilance in the feeding of a child after the first year has passed. The ideas of the laity in regard to what a child can digest after it has outgrown an exclusive milk diet, are very erroneous. The majority of infants are given solid food too early and in too large quantities. Most of the attacks of indigestion during the second year are directly traceable to such gross dietetic errors. The diet of a healthy child during the second year should consist of milk, some farinaceous food, bread, a small amount of animal food, such as beef or mutton, beef juice, eggs, and fruit.

Milk should be the basis of the diet. There are a few infants for whom no modification of the milk is necessary, as they are able to digest without difficulty that containing 4 per cent proteids. The great majority of infants do better if the proteids are kept at 3 or 3.5 per cent during the first half of the second year. If the fat is 4 per cent, chronic constipation, usually so troublesome at this time, may often be avoided. Since the child is now able to take a considerable proportion of its carbohydrates in the form of starch, it is not necessary to continue the large quantity of milk sugar given during the first year, and in many cases the sugar may be omitted altogether. However, where starch-digestion is so feeble that only a small quantity of farinaceous food can be allowed, it may be necessary to continue the milk-sugar during the entire second year. The formulæ most generally useful during this period are:

IX. At 12 months: Fat, 4·0%; sugar, 5·0%; proteids, 3·0%.
X. " 15 " " 4·0%; " 5·0%; " 3·5%.
XI. " 18 " " 3·5%; " 4·3%; " 4·0% (i. e., plain milk).

We may obtain approximately these formulæ by using the following proportions for one feeding of ten ounces:

Formula IX. Milk, 6 oz.; cream (16%), 1 oz.; water, 3 oz.; sugar, 2 even teaspoonfuls.
" X. " 8 " " " ½ " " 1½ " " 1 " teaspoonful.

Instead of plain water in these formulæ, we may use the same quantity of barley or oatmeal gruel or jelly.

Farinaceous food: The easiest plan is to add this in the form of a gruel made of one of the cereals or farinaceous foods (page 156); the latter being partly dextrinized, require but ten to fifteen minutes' cooking. If these prepared flours are used, one even tablespoonful should be added to one pint of water, to make a gruel of about the proper strength. We may use with equally good results a gruel or jelly made from oats, wheat, or barley. If the grains themselves are used, they should first be soaked for six hours or over night in water which is thrown away, and then cooked for from four to six hours and strained through muslin. Two tablespoonfuls of the grains to one quart of water, cooked down to one pint, gives a jelly of about the desired consistency. Salt should always be added to make it palatable.

During the first half of the second year children require from forty to fifty ounces (1,240 to 1,550 grammes) of fluid food daily; during the second half of the year from forty-five to fifty-five ounces. This quantity should be given in five feedings; four of these being of equal size, one—usually the midday feeding, which is given in connection with the meat or meat juice—being smaller.

Beef juice may be given as directed for the feeding during the latter part of the first year, the amount allowed being from one to three ounces daily. After the eighteenth month, if most of the teeth are present, rare scraped beef or mutton may be given at times in place of the beef juice. Not more than a tablespoonful should be allowed daily. After the eighteenth month, a soft-boiled fresh egg may also be given in place of the meat or meat juice, once or twice a week.

A small piece of stale bread dried in the oven, or a piece of zwieback may be given, usually with the midday meal, after the child has most of its teeth.

Fruit is a part of the diet too often omitted. Orange juice may be begun as early as the fifteenth month; from half an ounce to two ounces may be given daily. A little later one or two tablespoonfuls of baked apple or two or three stewed prunes may be added. Both should be cooked until they are very soft. The baked apple should be given without sugar, and the prunes should be put through a sieve to remove the skins. The best time for giving fruit is about an hour before one of the milk feedings.

The daily diet for a child of eighteen months should be arranged somewhat as follows: The first, second, fourth, and fifth meals should each consist of ten or twelve ounces of milk prepared with gruel, as above described, the fruit being given an hour before the second feeding. The third meal should consist of six or seven ounces of the milk and gruel, with beef juice, scraped beef, or egg, and dried bread. The form of farinaceous food may be varied from day to day, according to the child's taste. All other food may be advantageously omitted. Water only is to be allowed between the feedings.

The milk for the twenty-four hours is best prepared at one time. The quantity needed for the different feedings should be put in separate bottles, as during the first year. What was said regarding the heating of milk during the first year for sterilization, applies also to the second year.

Children can usually be taught to drink from a cup at from twelve to fifteen months.

DIFFICULT CASES DURING THE SECOND YEAR.

The number of children whose nutrition is a matter of difficulty during the second year is much smaller than during the first year; yet there are cases in which the difficulties are just as great. Some of these are infants that have been very delicate from birth, and carried through the first year only by the greatest effort. Others are healthy at birth, but their digestion has been badly deranged in consequence of improper feeding during the first year. Some are infants who did well until they were weaned, but from that time began to suffer from constant indigestion and malnutrition because they were put upon improper food, often undiluted cow's milk. In some the symptoms are the result of a severe attack of acute disease of the stomach or intestines during the first year. Many of them are rachitic. A frequent cause of trouble is that children have been put too early upon solid food, the mother often thinking that a child who is delicate is only to be built up by giving "strong food." Very often the difficulty is that the food has been excessive in starch, especially in the form of potato or oatmeal.

Whatever may be the cause of the symptoms, all cases of feeble digestion or chronic indigestion of the second year are to be managed very much in the same general way. Usually the first thing to be done is to stop all solid food except the rare scraped meat. Starches must be reduced to the minimum or prohibited altogether. In most cases milk, meat, and a little suitable fruit must constitute the diet. While it is undoubtedly true that the use of plain cow's milk often fails entirely, it is certain that nothing is more likely to succeed than cow's milk when properly modified. This must be continued as the principal diet, sometimes as the sole diet, for the greater part of the second year. The milk must be modified as for healthy infants who are from eight to twelve months younger than the patient under treatment. Thus a child of twelve or fourteen months, should be given milk prepared as for a healthy child of four or five months (formula VI, page 175); one of twenty to twenty-four months, as for a healthy child of from ten to twelve months (formula VIII, page 178). Milk containing a larger quantity of casein than in these formulæ, is rarely digested unless partly peptonized, and this may be required even with the lower percentages. The daily quantity should generally be somewhat larger than for a young, healthy infant taking food of the same strength. The regular intervals of feeding should never be shorter than three hours, and in many cases four hours is to be preferred. The number of meals usually required in the twenty-four hours is five.

From few things is more striking improvement seen in these patients than from the administration of rare meat-pulp, especially to those who are over eighteen months old. From one to two ounces may be given daily. Generally the proteids in the food have been previously deficient. Many of these children digest meat when given in this way better than they do the casein of the milk. Raw beef juice may be used with the meat, or from time to time may take its place.

The same fruits should be allowed as for healthy infants, the quantity being smaller. Inasmuch as it is with the starches that the greatest difficulty is usually experienced, the carbohydrates must be administered either in the form of milk-sugar or some of the malted foods. When starch is first allowed it should be given with some reliable preparation of malt.

When the child is once well started and gaining steadily, the food may be gradually modified, until the diet recommended for healthy infants is reached. All changes must, however, be made very gradually, and it should never be forgotten that there is a constant disposition on the part of all mothers and nurses greatly to over-feed these children.

FEEDING FROM THE THIRD TO THE SIXTH YEAR.

Articles allowed.—From the following list the diet of a healthy child may be arranged:

Milk.—This should be the basis of the diet; most children require about one quart daily. This usually needs no modification, but if somewhat difficult of digestion, it should be prepared as for the second year—six ounces of milk, one ounce of cream, and three ounces of water. The milk should usually be given warm.

Cream.—This is of great value, especially when there is a tendency to constipation. From two to eight ounces may be given daily. It may be used upon cereals, upon potato, in broths, and mixed with milk. In many cases it is advisable to withhold milk and give only cream.

Eggs.—These are a valuable form of proteid. They should be fresh, soft-boiled or poached, but never fried. Usually eggs should not be given oftener than every other day, as children readily tire of them.

Meats.—Some form of meat should be given once a day. The best forms are beefsteak, mutton chop, and roast beef or lamb; next to these the white meat of chicken, or fresh fish, which should be boiled or broiled. Beef and mutton should be given rare.

Vegetables.—Potato may be given once a day, preferably baked, with the addition of cream or beef juice rather than butter. Of the green vegetables the best are asparagus tops, spinach, stewed celery, string beans, and fresh peas. One of these vegetables should be given daily—always well cooked and mashed.

Cereals.—Nearly all these may be used—oatmeal, wheaten grits, hominy, rice, farina, and arrowroot. The most important part of the preparation is thorough cooking. If the grains are used, cereals should be cooked at least three hours, after having been previously soaked several hours. They should always be well salted, and given with milk or cream, but with little or no sugar.

Broths and soups.—The meat broths are preferable to the vegetable broths. Nearly all varieties may be given. Plain broths are not very nutritious, but when thickened with arrowroot or cornstarch, and when cream or milk is added, they are very palatable, and at the same time a valuable addition to the diet. Beef juice may be used as directed for the second year.

Bread and biscuits (*crackers*).—In some form these may be given with nearly every meal, better without butter until the fourth year, as for young children cream is a better form of fat. All varieties of bread may be allowed when stale; also dried bread, zwieback, and oatmeal, Graham, or gluten biscuits.

Desserts.—The only ones that should be allowed up to the sixth year are junket (page 152), plain custard, rice pudding without raisins, and, not oftener than once a week, ice-cream. Of the last three, the quantity given should be very moderate.

Fruits.—An effort should be made to give fruit in some form every day. Oranges, baked apple, and stewed prunes are the most to be depended upon. Raw apples in most cases should not be given. Peaches, pears, and grapes (with seeds removed) may be given when thoroughly ripe and fresh, but only in moderate quantity. Special care should be exercised in the use of fruits in very hot weather, and in cities where they may not always be fresh. Berries are best deferred until children are six or seven years old, and even then should be given very sparingly.

Articles forbidden.—The following articles should not be allowed to children under four years of age, and with few exceptions they may be withheld with advantage up to the seventh year:

Meats.—Ham, sausage, pork in all forms, salt fish, corned beef, dried beef, goose, duck, game, kidney, liver and bacon, meat stews, and dressings from roasted meats.

Vegetables.—Fried vegetables of all varieties, cabbage, carrots, potatoes (except when boiled or roasted), raw, or fried onions, raw celery, radishes, lettuce, cucumbers, tomatoes (raw or cooked), beets, egg-plant, and green corn.

Bread and cake.—All hot bread and rolls; buckwheat and all other griddle cakes; all sweet cakes, particularly those containing dried fruits and those heavily frosted.

Desserts.—All nuts, candies, pies, tarts, and pastry of every description; also all salads, jellies, syrups, and preserves.

Drinks.—Tea, coffee, cocoa, wine, beer, and cider.

Fruits.—All dried, canned, and preserved fruits; bananas; all fruits out of season and stale fruits, particularly in summer.

From the third to the sixth years four meals should usually be given daily and at regular intervals—e. g., 7 and 10.30 A. M.; 1.30 and 6 P. M. The second meal should, in most cases, be smaller than the others.

The following is a sample diet for a child of four years:

First meal.—Half an orange, two tablespoonfuls of some cereal well salted with two or three tablespoonfuls of cream, a glass of milk, one piece of bread with a little butter.

Second meal.—A glass of milk or cup of broth with bread or two or three biscuits (crackers).

Third meal.—Two tablespoonfuls of finely divided steak or chop, one tablespoonful of baked potato, one tablespoonful of spinach, bread and butter, a cup of junket, water to drink.

Fourth meal.—Milk with bread, or milk toast.

From the list of articles given above, a sufficient variety in the diet can be secured. The only way for the physician to be sure that proper food is given to young children, is to write out for the guidance of the mother or nurse two lists somewhat similar to the above, of articles forbidden and articles allowed. This plan I have followed for several years with the happiest results. It is rarely safe to trust anything to the judgment of the mother.

There are a few simple rules in feeding which should always be followed:

A child must be taught to eat slowly and thoroughly masticate his food. The food must always be very finely divided, for, as a rule, mastication is very imperfect even up to the sixth or seventh year. If the child is fed by the nurse, plenty of time should be taken for the meal. It is almost always the case that the food is given too rapidly. It is unwise continually to urge children to eat when they are disinclined to do so at the regular hours of meals, or when the appetite is habitually poor, and under no circumstances should children be forced to eat. Indigestible articles of food should not be given to tempt the appetite when ordinary simple food is refused, nor should these be allowed because of the notion that "the child must eat something." Food should not be allowed between meals when it is habitually declined at meal-time. If a child refuses to eat, and examination reveals no fault with the food prepared, it should seldom be offered again until the next feeding time. In all cases of temporary indisposition, no matter of what nature, and during periods of excessive heat in summer, the amount of solid food should be reduced and more water given. If milk is the food, it should be diluted.

FEEDING DURING ACUTE ILLNESS.

Infants.—This is an important part of the treatment of every acute disease in childhood, but especially so in infancy. Whether the illness be one of the eruptive fevers, diphtheria, pneumonia, or influenza, all cases must be fed in about the same way. It is much easier by proper feeding to prevent disturbances of digestion in acute disease, than to allay them when they have been excited. In infancy this complication often turns the scale against the patient. One of the most important conditions which must be taken into consideration is, that in every severe acute illness, especially if it is of a febrile character, the power of digestion is much diminished. One evidence of this is the onset with vomiting; another is the anorexia which accompanies the early stage of nearly all acute diseases, the child often refusing everything in the way of nourishment. We should respect this inclination and make it our guide in the treatment. On the other hand, there is great thirst from existing fever, and water is needed; withholding this will often cause the temperature to rise even higher than before.

In all acute febrile diseases the fundamental principle is, less food and more water. The total amount of food given in the twenty-four hours should be considerably less than in health. For infants the character of the food may generally be the same as in health, but should be given in very much greater dilution. For nursing infants this may be accomplished by making the nursing time shorter—four or five minutes, instead of the customary eight or ten—or a single breast, instead of both, may be given. Nursing children should be given water freely from a spoon or bottle. For those who are artificially fed, the amount of the ordinary food should be reduced by one third, or even one half, and this made up by adding water, at the same time allowing water freely between the feedings. In many cases the food must be not only diluted, but partly digested.

The food should be given at regular intervals, never less than two hours, even if the amount taken at a single time is small; otherwise the interval should be three hours. Regularity should always be adhered to. If food is given oftener than every two hours, vomiting and indigestion almost invariably result. The water allowed between the feedings should be boiled, given frequently, and in liberal quantity. When stimulants are required, they may be mixed with the water given. The foregoing rules apply to the early stage of most of the acute diseases of infancy, and in many cases this plan may be followed throughout.

Forced feeding—gavage.—Not a few cases, however, are seen in which, after a child has been several days sick, in consequence of delirium, stupor, sepsis, or some other serious condition, it may refuse all food or take so little that it is in danger of death from inanition. At this juncture forced feeding or gavage (see page 62) serves a most excellent purpose. Both food and stimulants can thus be introduced at regular intervals with slight disturbance, and lives saved which would otherwise be lost. If gavage is employed, the stomach should be first washed. The intervals of feeding should be made at least one hour longer than is customary in health, and usually predigested foods given.

In Older Children.—The same or similar conditions exist with reference to digestion in acute disease. These patients, however, are not so easily disturbed, and the disturbance of digestion is not so likely to be serious as in the case of infants. Even here the physician should direct the food to be given at regular intervals, usually not oftener than every three hours, but should never—as is so often done—order milk to be given to the child every time it asks for a drink. In most cases, for children under five years old, milk should be somewhat diluted, usually with limewater, and partly peptonized if the child's digestion is feeble. Children who do not take milk readily may be given beef tea, broth, gruel, or kumyss, but rarely ice-cream or jellies so frequently prescribed, as these, if given in any considerable quantity or very often, are likely to disturb the stomach and take away what little desire for food the child may have. Raw eggs are palatable when beaten up with sherry, a little sugar, and cracked ice. Fruits, particularly oranges, grapes, and grape fruit, may be allowed in almost every febrile disease, but never given within two hours of a milk feeding.

The water given may be plain boiled water, but better, in most cases, are some of the carbonated waters, Vichy, Seltzer, or Apollinaris, these being less likely to disturb the stomach.

It is certainly a mistake to force food upon older children in any disease in which their condition is not dangerous. But when there is sepsis, delirium, or coma associated with other dangerous symptoms, gavage may be resorted to with but little more difficulty, and with no less satisfactory results, than in infants.

CHAPTER V.

THE DERANGEMENTS OF NUTRITION.

THE derangements of nutrition form a distinct and a very large class in the ailments of infancy, particularly during the first year. The symptoms are sufficiently definite and characteristic for them to be regarded as separate diseases, and to be discussed as such. In adults such symptoms are seldom seen except in connection with organic disease. These cases are often very puzzling, and in a large number of them a diagnosis of some constitutional disease, such as hereditary syphilis, or tuberculosis, or organic disease of the stomach or intestines, is erroneously made. At other times the symptoms resemble those of acute toxæmia. The essential condition in all these cases is the inability of the infant to get from its food what its system needs. It can not digest or assimilate enough to support life. It is unable to replace from its food the daily waste of its tissues. The constructive metabolism is not equal to the destructive metabolism of the body; the process is, therefore, essentially starvation, which may be rapid or slow, according to circumstances.

The fault in these cases is partly with the digestion, but principally with the food. The problem is, to adapt the food to the digestion of the particular child under consideration. The solution is often very easy at first, but the difficulties multiply rapidly the longer the condition has lasted. It is therefore essential that the true explanation of the symptoms should be recognised at the earliest possible moment. Changes occur so rapidly in very young infants that a mistake in diagnosis and a consequent delay of a few days, may be sufficient to determine a fatal result. The outcome in cases of imperfect nutrition depends almost entirely upon their management. The condition is not one which tends to right itself. Spontaneous improvement or recovery rarely takes place. In order to recognise the condition and anticipate the result, nothing is so important as a close observation of the body-weight. A child whose nutrition is a matter of difficulty should be weighed regularly, in the early months twice a week, and once a week throughout the first year. If this is done, the first symptoms of failing nutrition are unerringly detected. If a child does not gain in weight something is wrong, and a steady loss in weight in an infant is a warning which should never be unheeded; for, unless the conditions are changed, it is practically certain to continue, and generally with increasing rapidity, until the infant's vitality has been reduced to such a point that no means of treatment can restore it. The younger the child, the more rapid the loss, and the longer it has continued, the greater is the danger.

For convenience of description these derangements of nutrition have been divided into three groups, differing, however, rather in degree than in kind.

1. Cases of acute inanition, which are quite rapid, generally lasting from a few days to a few weeks. They are rare except in young infants, being most frequently seen in the first three months.

2. Cases of malnutrition, in which the symptoms are much less severe than in the other groups, although they may be of long duration. While it is most common in the first two years, malnutrition may be seen at any age.

3. Cases of marasmus. This is similar to inanition, but a much slower process, lasting usually for several months. It may be seen in infants of any age.

ACUTE INANITION.

Inanition, or starvation, is a condition depending upon lack of assimilation. It is common in early infancy, when it often simulates serious organic disease. In older children it is not so frequent, and not usually so obscure. In all the acute diseases of the digestive tract many of the symptoms are due to inanition. The cases considered in the present chapter, however, are those in which there is no such association, or where the digestive symptoms, strictly speaking, are not prominent.

Etiology.—The essential cause of inanition is that the child does not get sufficient food, or that the food taken is not assimilated. It usually develops under one of the following conditions: (1) When a child refuses all food, whether from the breast or the bottle, or can be made to take only so small an amount that it is not enough to support life. The cause of this it is often impossible to discover. I have seen it in a variety of circumstances—once recently in an infant five months old, previously healthy, who was suffering from whooping-cough. This infant utterly refused the breast, and from the spoon would take less than two ounces a day. This continued for four days, at the end of which time its symptoms were quite alarming. Gavage was then begun, and its life, I think, saved by this procedure. (2) When the food given is entirely inadequate, as when an infant is nursing upon a dry breast, or one in which the milk supply is so scanty that the child gets practically nothing. This is most frequent during the first two weeks of life. (See page 118.) I have occasionally seen it later, when an infant was put upon the breast of a wet-nurse whose milk, for some unexplained reason, had suddenly failed. (3) Where the character of the food is improper. Breast-milk may be not only scanty, but of very poor quality. On account of extreme poverty, the infant may be getting only tea, as I have known to be true in several cases before admission to the hospital. In some cases a very young infant may be fed entirely on starchy food. (4) Where the infant at birth has such feeble powers of digestion, beause premature or delicate, that it is unable to digest enough of the food given to maintain life. Sometimes this food is breast-milk, which, though abundant, is of inferior quality and can not be assimilated. Very often it is some proprietary food. (5) When a sudden change of food is made to one so difficult of digestion that the child is unable to assimilate it. This may happen after sudden weaning. In such cases the symptoms of inanition are mingled with those of acute indigestion, but the former usually predominate.

In children over one year old, and sometimes in younger ones also, the symptoms of inanition follow those of some acute disease, such as influenza, malaria, pneumonia, or even otitis. Although they may recover from the acute process, the general vitality is so much lowered that assimilation is not sufficient to replace the waste of the body.

Symptoms.—The mode of development depends upon the antecedent condition. In young infants inanition often follows malnutrition where perhaps there has been nothing noticeable except a gradual loss in weight; and if the weight has not been watched, it may be observed only that the infant has not been doing well. Severe symptoms may come on quite suddenly, and if the nature and the gravity of the condition are not appreciated the case may terminate fatally in two or three days. The loss in weight is now rapid, amounting often to three or four ounces a day. The temperature is variable: in the newly-born it is often high, but it may be subnormal, or it may be normal. The pulse is always weak and rapid. The extremities are usually cold and the peripheral circulation poor. There is marked general prostration. The skin may be dry, or it may be covered with a clammy perspiration. There is extreme pallor, and in the most severe form there is cyanosis. This may be marked and may last for two or three days, gradually deepening until death occurs, or it may disappear entirely and recovery follow. Cyanosis may be present in children who have previously cried well and in whom there is no suspicion of atelectasis. The respirations are rapid and may be irregular. There may be constant worrying and fretfulness, or a condition of semi-stupor, in which the child makes no sign of wanting food. The fontanel is sunken and the pupils are often contracted. The stools contain undigested food, or if predigested foods are given they seem to pass through the intestines unchanged. The bowels usually move frequently, although in rare cases there may be constipation. When all food is refused for two or three days the stools may resemble meconium, as I once saw in a child six months old. While no desire for food is manifested, infants will sometimes swallow food when it is offered, retaining everything given for several feedings, when the whole quantity is vomited.

The course of the disease depends much upon the age of the infants. Those under one month succumb most quickly. In them the symptoms sometimes last but two or three days, seldom more than a week or ten days, the children simply drooping steadily until death occurs. With proper treatment complete recovery may take place in a week. In older infants the progress, whether upward or downward, is usually less rapid.

Prognosis.—The outcome of these cases is always uncertain. In few conditions is it more so. It is hard for one who is not familiar with the condition to appreciate the great and even the immediate danger in which a young infant may be from inanition, especially in the absence of both vomiting and diarrhœa. It is difficult to estimate the gravity of an individual case except after twenty-four hours' observation. The best of all guides is perhaps the weight. Where the loss is several ounces each day the chances of recovery are small. The presence also of frequent vomiting or of diarrhœa makes the outlook very bad. A high temperature, very marked relaxation, copious perspiration, cold extremities, and cyanosis are all bad symptoms.

Diagnosis.—Inanition is distinguished from malnutrition by its greater severity, and from marasmus by its more acute character. The usual mistake is that of confounding inanition with some local or constitutional disease. It may be mistaken for acute indigestion, meningitis, gastro-enteritis, pneumonia, and for some of the fevers. The temperature when elevated is especially likely to mislead. This is not often seen except where little or no food is taken or retained.

Treatment.—The existence of inanition in young infants presupposes only the feeblest powers of digestion and assimilation. If possible, a good wet-nurse should be secured, for in most of the cases the time for action is so short that there is no opportunity to experiment with artificial feeding. This is one of the few conditions in which wet-nursing is almost indispensable. If a wet-nurse can not be obtained, a diluted milk like formula XIV (page 176) may be given after being peptonized for two hours. If food is not readily taken, it should be given by gavage. This is frequently necessary, as very many of these infants will not take food at all, or only in such small quantities as to be insufficient for nourishment. If there is vomiting, even greater dilution may be required. If food so prepared is not retained, kumyss, whey, animal broths, and malted foods may be tried in succession. Wherever the symptoms have come on very rapidly, temporary improvement sometimes results from the hypodermic use of a one-per-cent saline solution, two ounces every five or six hours. The amount of food actually taken in the twenty-four hours should be noted, as it is often found to be only one fourth that which is actually needed for the child's nutrition.

The general treatment includes stimulants and the careful regulation of the body temperature. If there is fever, sponging with tepid water, cold to the head and heat to the extremities may be employed. If the temperature is subnormal, the child should be rolled in cotton and surrounded by hot-water bottles, or put into an incubator. Stimulants are required in most cases, the best form being some of the beef peptonoids with wine, given in frequent, small doses. As soon as the child begins to improve, one must be careful about increasing the food too rapidly, for renewed vomiting with an aggravation of all the other symptoms, is almost certain to follow such a mistake.

In older infants the symptoms of inanition may develop when a child who is suddenly taken from the breast absolutely refuses all other forms of nourishment. This may continue for three or four days until the symptoms are quite alarming. For such cases gavage may be employed, and formula XII or XIII (page 176) given, peptonized two hours.

When inanition develops in children over a year old it is usually after an attack of some acute disease. They lie in a dull, apathetic condition, sometimes with subnormal temperature, showing no desire for food. The circulation is poor, the skin dry; there may be small petechiæ upon the abdomen; bedsores form with great rapidity over the heels, sacrum, or occiput. There may be no vomiting, and the stools may appear quite good. Something seems to be needed here to arouse the slumbering cells to activity, and massage, external heat, hot baths, together with careful feeding, temporarily upon predigested foods, are means by which a few of these cases can be saved; but the majority sink gradually and die of exhaustion, the autopsy showing no sufficient explanation of the symptoms.

MALNUTRITION.

Cases of malnutrition are exceedingly common, and occupy a large part of the time and attention of one engaged in practice among children. Although these children can not be said to be actually ill, they are very far from well, and their condition is often the cause of the greatest solicitude on the part of anxious parents, not only from the existing state of health, but from the apprehension of the development of some serious organic or constitutional disease, especially tuberculosis.

Etiology.—Malnutrition may depend upon inherited conditions. Certain children are delicate from birth, possessing only feeble physical vitality, but without giving evidence of any actual disease. They are often the offspring of parents of delicate constitution, or of those with inherited tuberculosis, gout, syphilis, or alcoholism. Very many city children are included in this group. They are a product of modern life, in whom is seen a too highly developed nervous organization with a corresponding amount of physical deterioration. In another group of cases the children are premature or very small at birth, weighing perhaps only three or four pounds. Many cases are traceable to improper feeding or equally poor nursing during the first few months. These children get a bad start in life, and on that account are handicapped throughout infancy. In many cases malnutrition develops as a result of the patient's surroundings. While this is common among the poor, it is not rare among the better classes. One of the most frequent causes is the pernicious custom of keeping infants in close apartments where the thermometer ranges from 72° to 78° F., and where the greatest anxiety is constantly felt lest the children take cold. Such infants may lose in weight, become anæmic, and exhibit all the signs of malnutrition where nothing else is wrong except the conditions mentioned. In infants, malnutrition often depends upon some previous acute disease, especially of the stomach and intestines, and sometimes of the lungs.

In children who are over two years old the condition of malnutrition may be due to any of the factors above mentioned—inherited feebleness of constitution, bad feeding and its resulting indigestion, too little fresh air, and close confinement indoors. It is, however, at this period much more frequently than in infancy, dependent upon some previous acute disease. This may have been acute broncho-pneumonia, acute ileo-colitis, influenza, malaria, or any of the eruptive fevers. As a result, an impression is left upon the child's constitution which lasts for months, often for years, and which manifests itself not by any special local symptoms, but by a general condition of debility or malnutrition. Sometimes such diseases, instead of being directly the cause of the symptoms, are the occasion which brings out some latent inherited taint or constitutional weakness in children who up to this time, perhaps, have appeared exceptionally healthy. In other cases malnutrition depends upon faulty methods in education, especially upon overpressure in schools.

Symptoms.—*In infants.*—In weight these children are much below the average, and the weight is stationary or the gain very slow, often only five or six ounces a month at a period when it should be from one to two pounds. In a case recently under treatment, a child at fourteen months weighed but eight and a half pounds. This infant at birth weighed three and a half pounds, but in the course of a few weeks the weight dropped to two pounds. Not only is the weight low in these cases, but the growth of the body in every respect is delayed. At one year, the length is often only four or five inches more than at birth. Dentition is usually but not invariably delayed. I have repeatedly seen children suffering from a very marked degree of malnutrition in whom dentition was normal. In muscular development such children are always very backward, often not sitting alone until they are a year old, making no attempt to stand until the middle of the second year, and not walking alone until the end of the second or the middle of the third year. The muscles are soft and flabby and the ligaments weak.

Anæmia is invariably present, and varies much in degree, being rarely extreme. The circulation is commonly poor, the hands and feet are frequently cold. In many children the skin is unnaturally dry; in others there is a disposition to excessive perspiration, particularly about the head. Nervous symptoms are usually present. These children are restless, fretful, and irritable; they sleep badly during the day, and often worse at night. Enlargement of the lymph glands is common, especially in the neck. The cervical adenitis may have started from a slight catarrhal cold, but the glands continue to swell after this has subsided and may remain enlarged for months.

One of the most characteristic things about these infants is their feeble powers of digestion and assimilation. Unremitting care and constant watchfulness are required to keep them up even to a moderate standard of health. The most trivial changes in food may upset them. Attacks of acute indigestion are usually brought on by overfeeding—the mistake which is almost invariably made by mothers who are discouraged with the slow progress made, and are anxious to make their children grow fat and strong. The balance is so delicately adjusted that the slightest deviation from proper rules of feeding, either as to the quality of the food or quantity given, is immediately followed by an attack of acute indigestion, often by severe diarrhœa. As a result, the child may lose as much in two or three days as it has gained in a month or more. These acute attacks in summer not infrequently prove fatal. Not only do these patients have but little resistance to acute disturbances of the stomach and intestines, but any acute disease is serious—measles, whooping-cough, and pneumonia being especially fatal.

Among the poor or in institutions, cases of malnutrition like those described, if they are under nine months old, are almost certain to go on from bad to worse until they have reached the condition described as marasmus. Between this and malnutrition no sharp line can be drawn; they are rather different degrees of the same general process. In private practice, where it is possible to have the best care and surroundings, with the co-operation of an intelligent mother or nurse, a very large number of these infants can be reared. After the second year has passed the problem becomes a much simpler one, and if infectious diseases and other forms of acute illness can be avoided, the probabilities are in favour of the child's growing to maturity and becoming stronger each year.

In older children.—In general appearance these children are thin, spare, and very often undersized, particularly if the condition is constitutional or hereditary. In other cases they are taller than the average for their age, and their symptoms are often attributed to too rapid growth. One of the most striking things about children suffering from malnutrition is their vulnerability. They "take" everything. Catarrhal processes in the nose, pharynx, and bronchi are readily excited, and, once begun, tend to run a protracted course. There is but little resistance to any acute infectious disease which the child may contract. One illness often follows another, so that these children are frequently sick for almost an entire season. Their muscular development is poor, they tire readily, are able to take but little exercise, and their circulation is sluggish. Nervous symptoms are usually present. Many of these would be called nervous children. They are cross, fretful, and any unusual excitement produces an effect which lasts for some time; for example, after a children's party or a Christmas tree they may lie awake half the succeeding night, and may be really ill for two or three days. Their sleep is usually disturbed and restless; they waken frequently, and occasionally suffer from night-terrors. At a later age they are favourable subjects for chorea, neuralgia, and all functional nervous disorders.

Digestive symptoms, if not constant, are very easily excited. In fact, they do not suffer so much from chronic indigestion as from a delicate or feeble digestion, which is easily upset by the slightest deviation from the regular routine. Children of five or six years have to be fed as carefully as infants of eighteen months or two years. The appetite is usually poor, and mothers are distressed because their children eat so little, yet, when food is urged upon them, attacks of indigestion follow with singular uniformity. The tongue is slightly coated the greater part of the time. The bowels are apt to be constipated, apparently more from lack of muscular tone than from anything else. From time to time, from slight causes, such as exposure to cold, or even fatigue, there may be large quantities of mucus in the stools for two or three days at a time, although this is not a prominent feature of most of these cases. When they are not fed with the greatest care these children suffer constantly from indigestion. A moderate amount of anæmia is always present, and in some cases this is one of the most striking features of the disease. In very many children with a marked disturbance of nutrition, there is an excessive elimination of uric acid.

The duration of these cases depends very much upon the cause. If the cause is constitutional or inherited, the condition may last throughout childhood. Where it follows some acute illness it commonly lasts for a few months only; but the effect of an acute attack of broncho-pneumonia or of ileo-colitis may last for years. If the malnutrition is the result only of the child's surroundings, like the confinement incident to city life, very rapid improvement and prompt recovery may follow a removal to the country.

Diagnosis.—The physician should not be too ready to make a diagnosis of simple malnutrition. Before accepting such a diagnosis, he should examine the child with the greatest care, to exclude the common organic and constitutional diseases of children. Much regarding inherited constitutional tendencies can be learned from the family history and from the condition of the other children. In the first place, tuberculosis, syphilis, and rickets should be excluded; then chronic malaria and the diseases of the blood; and, finally, organic diseases of the lungs, heart, stomach, intestines, liver, and kidneys. Even malignant disease, though rare, should not be overlooked. It may take careful observation for several days, and sometimes for weeks, with repeated physical examinations, before all these conditions can positively be excluded.

The next step in the diagnosis is to discover upon which one of the many possible causes, malnutrition depends. In my own experience in private practice the proportion in infancy has been about as follows: sixty per cent due to improper feeding or nursing; twenty per cent to improper surroundings, particularly to hot rooms and want of fresh air; and twenty per cent to inherited constitutional conditions. In other words, most of these children are born healthy, but become ill or delicate in consequence of improper management.

In older children, after excluding constitutional and local diseases, the whole life of the child must be investigated to discover the fundamental condition which is at fault. It is often difficult, and sometimes impossible, to get at this primary factor, for in cases of long standing there may be symptoms connected with almost every function of the body. One should scrutinize closely the quality and quantity of food given, the amount of sleep, the hours of study and recreation, the amount of exercise in the open air, and the psychical conditions surrounding the child. Usually we can decide which is the most important factor in the case.

Prognosis.—An accurate diagnosis carries with it the data for prognosis. If the cause can be discovered, and if it is one which can be removed, the prospects are good for improvement, and usually for complete recovery. The longer the cause has been operative, the more profound will be the general disturbance of nutrition, and the longer the time required for improvement. Cases due to improper feeding or surroundings usually improve immediately when a proper *régime* is instituted, and the worse the previous management of the case has been the more marked is the improvement to be expected. In these cases everything depends upon the fidelity with which the directions given in regard to diet and surroundings can be carried out. The cases which offer the greatest difficulties are those in which the condition of malnutrition depends upon an inherited delicate constitution; although these may improve, they require the closest attention throughout childhood. Without the co-operation of an intelligent and devoted mother, or an experienced nurse, very little progress can be made.

Treatment.—This is a problem of nutrition to be solved by diet and general management, drugs occupying a very small place.

In infants.—In very young infants treatment is chiefly a question of feeding. If possible a wet-nurse should be secured. If this is impossible, artificial feeding should be carried on according to the rules given in the chapter upon the feeding of delicate children and those with feeble digestion. (See page 180.) These children often do fairly well during the first year, but after this time has passed mistakes are most frequently made, on account of the failure to appreciate the fact that, although over twelve months old, these children in point of development resemble healthy infants of four or five months, and are to be managed as such. If possible, weaning should be deferred until the sixteenth or eighteenth month, or at least partial nursing should be continued until that time. When cow's milk is begun it should always be very largely diluted, usually modified as for a healthy infant a month old. (See formula IV, pages 174, 175.) It is surprising to see with what uniformity the giving of cow's milk, pure or slightly diluted, will produce attacks of indigestion in these infants. I have seen a single feeding in which one ounce of milk was given, and that diluted three times, produce a violent attack of acute indigestion which proved well-nigh fatal. Feeding during the entire second year should be carried on very much as in ordinary healthy children from the sixth to the twelfth month. A deviation from this rule almost invariably results disastrously. One must be guided in the amount and character of the food not so much by the child's age as by its digestive capacity, and in most cases this is much feebler than the mother or even the physician supposes. In many of these cases, cow's milk—for them the most valuable of all foods—has been excluded from the diet, when the only trouble is that it has not been given in sufficient dilution. For some children it must be partially peptonized during periods when digestion is especially feeble.

Next in importance to diet is the question of fresh air. Oxygen is the best of all tonics for these children. Often they will not improve with any variation in diet until fresh air is allowed. Then increased digestive power is seen in the course of a few weeks, sometimes in a few days. The natural tendency of a mother who has a delicate infant, or one suffering from malnutrition, is to house it closely and never allow it a breath of fresh air. Even in winter this may be obtained by changing apartments, or by airing in the room with the windows open. In the beginning this should be done for a few minutes only, the time being gradually increased to two or three hours each day. The child should be clothed as for the street, and, if necessary, hot bottles should be placed at the feet. Experiments which I have lately made in the hospital with these delicate infants, have proved conclusively the value and safety of this plan.

Cold sponging is another valuable tonic. After the morning bath is given, at 90° F., the entire body should be sponged for a moment with water at a temperature of 60°, or even 55° F. This produces a certain amount of shock and causes loud crying, which is of itself beneficial. How frequently this should be used will depend upon the reaction following it. If the child remains blue and cold for some time afterward, the cold sponging should not be repeated. If there is a good reaction and improved colour, it may be used daily.

Friction and massage are useful in many cases. The child should be laid upon the lap of the nurse, if possible before an open fire, and should always be covered with a blanket. The entire body may now be rubbed for ten or twenty minutes with the bare hand, or, better, with cocoa butter. Simple rubbing may be used, or the usual movements of massage employed. If the latter, they should be very gentle at first, and only for a short time. Professional operators are inclined to be too energetic for little children. There is no advantage in rubbing with cod-liver oil instead of cocoa butter, while the odour makes it decidedly objectionable.

The only tonics I have found of much value are alcohol, nux vomica, and cod-liver oil. Alcohol may be given in the form of port or sherry wine. Nux vomica may be given alone or with the wine. Cod-liver oil is too much used in these cases, and in too large doses. Many of these infants can not take it at all. It should rarely be given when the tongue is coated and the appetite very poor. The dose should always be small—e. g., ten drops of the pure oil three times a day, or twice as much of an emulsion. In these doses it may be given for a long time without disturbance.

The secret of success in treating cases of malnutrition is, to hold the patient to a regular routine in feeding, sleep, and in everything relating to his life. Experiments are nearly always unfortunate. The physician should lay down in writing for the guidance of the mother, specific rules with regard to the amount of food, the time at which it is to be given, the hours of bathing, sleep, and airing, and should insist upon their rigid enforcement. Good results are obtained only by constant watchfulness, and although they may not be seen at once, they are in most cases sure to come if the mother will co-operate. In my own experience no class of patients have given me so much satisfaction as cases of malnutrition in infancy.

In older children.—The same general principles are to be applied to them as to infants. The diet is of the first importance. Only the simplest, plainest, and most easily digested articles of food should be given. Milk, beef, eggs, bread, and fruit should form the staple diet. All sweets, pastry, highly seasoned food, candy, nuts, tea, and coffee should be absolutely prohibited, and, in fact, none of the articles mentioned as "forbidden" on page 189 should under any circumstances be permitted. When the appetite is poor and simple food not well taken, the child should not be allowed to take indigestible articles for the sake of eating something. Nothing should be given between meals, and regular hours of feeding must be followed. Usually I have found three meals a day, for children over three years old, better than the practice of giving more frequent feedings. But this is not always the case. Under no circumstances should children be coaxed, urged, or hired to eat; much less should they be forced to do so. There is a popular misapprehension in regard to the variety in diet which children need. Most cases do better when a very simple and fairly uniform diet is continued.

The general habits of children should be directed; there should be regular and early hours for retiring, freedom from undue excitement, and interest should be awakened in out-of-door amusements. Children should be kept as much as possible in the open air; usually they do much better if they can be in the country during the entire year. Only a limited amount of reading and study should be allowed; and if children are at school, care should be taken that overpressure is not the cause of the symptoms, particularly in an ambitious child. The cold sponging given in the morning, as described on page 55, is extremely beneficial to children who are prone to take cold readily. Massage is useful for the benefit which it affords to the chronic constipation which is so frequently a symptom of malnutrition.

Of the tonics, iron, arsenic, and cod-liver oil are required in most cases, and the amount and combination may be varied from time to time, with the season of the year and the condition of the child's digestion.

MARASMUS.

Synonyms: Athrepsia, infantile atrophy, simple wasting.

Wasting is a symptom of many conditions in infancy. It occurs in tuberculosis, in infantile syphilis, and also as a result of acute or chronic disease of the stomach and intestines. Cases of wasting dependent upon such causes are not included in this chapter.

Marasmus is the extreme form of malnutrition seen in infancy, occurring, so far as is now known, without constitutional or local organic disease. It is a vice of nutrition only.

Etiology.—Marasmus is not often seen in the country or in private practice. It is frequent in dispensary practice in all large cities, and is especially common in institutions for young infants. In my own experience in four hospitals for infants, more than one half the deaths were directly or indirectly from this cause. Marasmus is a very large factor in the immense infant mortality of large cities in summer. Although the cause of death is usually reported under some other name, the determining factor in the fatal result is the previous marantic condition of the patient. The primary cause may be an inherent weakness of constitution which may depend upon heredity. It is often seen in premature children and in the illegitimate offspring of girls of sixteen or eighteen. In the vast majority of cases, however, it depends upon two factors—the food and the surroundings. Among the poor who live in tenements, infants who are artificially fed almost invariably do badly. This is due to ignorance in regard to the proper methods of infant-feeding and inability to procure what the child requires, especially pure cow's milk. A country infant may be neglected in many respects, and is often badly fed; but it has plenty of pure air, and usually thrives. In the city, as long as an infant has a plentiful supply of good breast-milk it continues to do well in most instances, in spite of the fact that its surroundings are bad. When there are not only bad feeding and unhealthful surroundings, but also an inherited constitutional vice, we have all the factors required to produce marasmus in its most marked form. The odds are so against the infant that its feeble spark of vitality flickers for a few months only and gradually goes out.

Another prominent factor in the production of marasmus is the overcrowding of infants in institutions. Even though artificially fed after the most approved methods, I have seen scores of infants who were plump and healthy on admission lose little by little, until at the end of three or four months they had become wasted to skeletons—hopeless cases of marasmus, dying of some mild acute illness, such as an attack of indigestion or bronchitis, the essential cause, however, being marasmus. The common mistake is that of placing too many children in one ward, with no chance of obtaining a proper amount of fresh air. No house-plant is more delicate or sensitive to its surroundings than an infant during the first few months of life.

Lesions.—The post-mortem findings in cases of marasmus are exceedingly unsatisfactory, and throw little if any light upon the disease. Every now and then general tuberculosis is discovered in patients dying apparently of marasmus, the existence of which was not previously suspected. In perhaps one third of the marked cases there is found a fatty liver. The organ is enlarged, often sufficiently so to be made out during life; its weight may exceed the normal by one half, or it may be doubled in size. Both to the naked eye and under the microscope, it presents the usual changes of fatty degeneration, often to an extreme degree. The significance of this lesion I do not know. It is to be compared with the similar condition seen in tuberculosis and other chronic wasting diseases. It may be looked upon either as a cause or a result of the pathological process.

With these exceptions the autopsies show nothing of importance, and I have had opportunity to make at least two hundred of them. The lesions usually found are the following: The brain is commonly anæmic, with dark fluid blood in the sinuses, marantic thrombi being rare. A strip of hypostatic pneumonia, from one to two inches wide, is seen along the posterior border of both lungs, involving the lung to the depth of half an inch, or less. In the younger infants there are frequently areas of atelectasis in the lower lobes. The pleura is almost invariably normal. The heart is pale, with perhaps a slight increase in the pericardial fluid. The spleen and kidneys are pale, but otherwise normal. The stomach may be dilated; the mucous membrane is usually pale, often coated with tenacious mucus. The intestines contain undigested food, sometimes mucus. The solitary follicles of the colon and small intestine, and sometimes Peyer's patches, are slightly enlarged, the mucous membrane in other respects being normal. The mesenteric glands are often slightly enlarged. In addition to the above, there may be evidence of some recent disease from which the patient has died—acute bronchitis, broncho-pneumonia, or a slight intestinal catarrh.

The above lesions represent what has been found in the great majority of the cases, and very disappointing they are to one who sees them for the first time. Nor does the microscopical examination of the organs throw any light upon these cases. I have personally examined with care the stomach and intestines of more than a dozen cases, several of them in which autopsies were made only two or three hours after death, without finding anything of pathological importance. The theory advanced by certain German writers, that atrophy of the intestinal tubules is the explanation of marasmus, has found no support in my observations.

The true pathology of marasmus seems to me to be a failure of assimilation from imperfect digestion, due to improper food, unhygienic surroundings, or feeble constitution. As a result, there is a progressive loss in weight, feeble circulation, imperfect lung expansion, imperfect oxidation of the blood, lowered body temperature, and, finally, a deterioration of the blood itself. Each of these effects becomes in turn a cause aggravating all the others, continuing until a condition is reached which is incompatible with life, for resistance becomes so feeble that the slightest functional disturbance proves fatal.

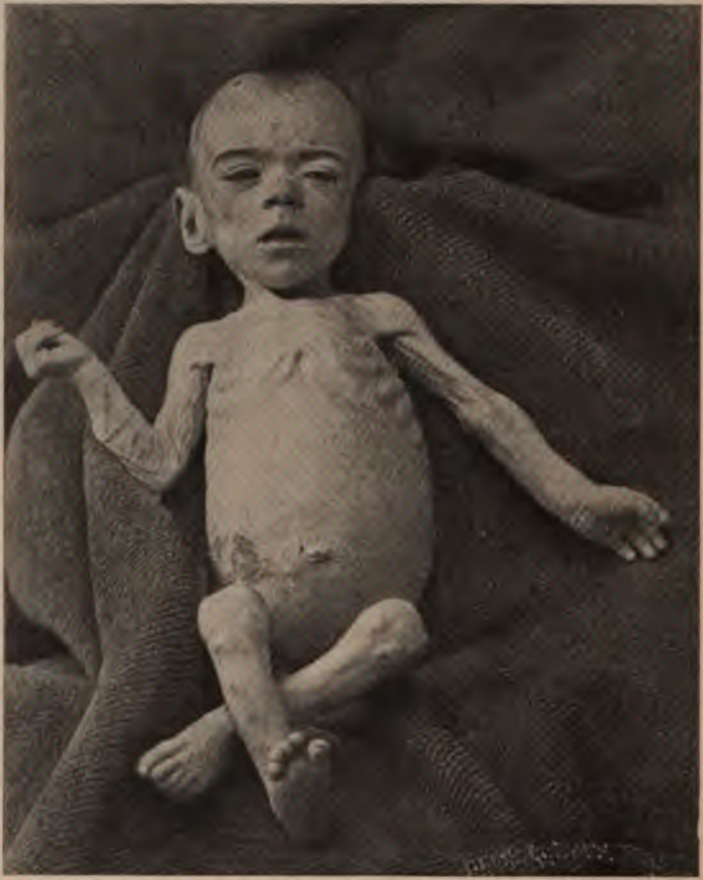

FIG. 31.—Marasmus; a patient in the Babies' Hospital, ten months old, weight six pounds. Weight at birth reported to have been nine pounds.

Symptoms.—The general history of these cases is strikingly uniform. The following is the story most frequently told at the hospital: "At birth the baby was plump and well nourished, and continued to thrive for a month or six weeks while the mother was nursing it; at the end of that period, circumstances made weaning necessary. From that time the child ceased to thrive. It began to lose weight and strength, at first slowly, then rapidly, in spite of the fact that every known form of infant-food has been tried." As a last resort the child, wasted to a skeleton, is brought to the hospital.

The most constant symptom is a steady loss in weight. The general appearance of these patients is characteristic. They have an old look; the skin is wrinkled, has lost its tone, and hangs in folds upon the extremities (Fig. 31). The legs are like drumsticks; the abdomen is prominent; the temples are hollow; the eyes large; the features sharp; and the hands resemble bird-claws. Often the children are reduced literally to skin and bone. Anæmia is a very marked and almost a constant symptom, the amount of hæmoglobin being frequently reduced to 30 per cent., and in one case of mine to 18 per cent. Anæmic heart-murmurs are frequently heard. The body temperature is usually subnormal, unless artificial heat is used. A rectal temperature of 96° or 97° F. is very common, and one of 94° or 95° F. is occasionally seen. In addition to the pallor of the face, there may be a leaden hue due to congenital or acquired atelectasis. An occasional symptom is general œdema, depending upon the condition of the blood or blood-vessels. The first thing which calls attention to this is often an unexpected gain in weight. The œdema may increase until the cellular tissue of the whole body is affected. I have never, however, seen effusions into the large cavities. Œdema is usually associated with marked anæmia, and is generally a very bad symptom. The stools are sometimes normal, but usually contain undigested food, and are large in proportion to the amount of food taken. No matter how carefully fed, these patients are easily upset. Now and then mucus is seen in the discharges, but this is not a constant or a marked feature. Vomiting is excited from the slightest cause, and often food is regurgitated almost as soon as swallowed. The appetite, in a severe case, is almost entirely lost; children refuse to take food from the bottle or spoon, and unless fed by gavage they die of inanition. In the earlier cases there may be an unnatural hunger, so that the children cry much of the time, and are relieved only when the bottle is given.

The complications are thrush, erythema of the buttocks, and bedsores, sometimes over the sacrum and heels, but most frequently upon the occiput. Occasionally there is seen a reflex spasm of the muscles of the neck, producing a marked opisthotonus, which may last for several days or weeks.

The course of the disease in most cases is steadily downward. It may be cut short at any time by acute disease. Frequently these infants die suddenly when they have apparently been as well as for several weeks. In many instances the autopsy reveals no explanation of this sudden death; but in other cases it is due to the regurgitation of food, and its aspiration into the larynx, the patient being too weak to cough. Rarely, death occurs from convulsions. In summer, these children wilt with the first days of very hot weather, and die often in a few hours from a slight functional derangement of the stomach and bowels.

Diagnosis.—No sharp line can be drawn between marasmus and malnutrition. In the wasting which follows chronic disease of the stomach and intestines there is usually a history of an antecedent acute attack. The chief difficulty in the diagnosis of marasmus is to exclude tuberculosis. In some cases a differential diagnosis is impossible during life. Not infrequently tuberculosis is found at autopsy, even in infants of a few months, in whom there have been no symptoms except those of marasmus. Even when the signs in the lungs are present, if situated posteriorly, they may be due either to tuberculosis or to the hypostatic pneumonia which is present. Signs in front are more significant; and consolidation anteriorly makes tuberculosis almost certain. In simple wasting there is often a history that the child was in splendid condition at birth, and continued so until it was weaned, from which date it has gone down steadily. In tuberculosis no such definite cause may be present; the children are often very delicate from birth. Simple wasting is so much more common that the chances are always in its favour.

Prognosis.—This depends on the age of the infant and the extent and duration of the disease. If the child is over eight months old, the chances of recovery are much better than in one under four months, for the fact that it has lived so long is generally evidence of pretty strong vitality. Very young infants are always difficult subjects to deal with. They go down more rapidly, and build up more slowly than those who are older. In most other circumstances the prognosis is much worse in cases of long duration. In a given case much depends upon whether everything possible can be done for the child—whether a wet-nurse can be secured or artificial feeding done in the best manner, and whether the patient can have the benefit of the best surroundings, in the country in summer and a warm climate in winter where it can be kept out of doors the greater part of the time. In institutions cases under four months old are usually hopeless. Of those over eight months quite a proportion can be saved by proper treatment, even though the body-weight is reduced to eight or nine pounds. When recovery occurs it may be complete, and the child at three years may be as vigorous as any child of its age. All these statements refer only to cases of simple marasmus. The presence of organic disease puts the case in another category.

Treatment.—The most important is that which relates to prophylaxis. This, for large cities, may be summed up in a single sentence: giving the poor the opportunity to obtain pure cow's milk and teaching them how to feed it to young infants, and at the same time giving ample opportunities for obtaining fresh air. In institutions the most important thing is to give adequate air-space for each child. Often only four or five hundred cubic feet are allowed, when at least eight hundred are necessary, even with the best ventilation. Children should be changed from one apartment to another and opportunities given for thorough airing, and there should be perfect ventilation, not only in the daytime but at night.

As far as possible, wet-nurses should be obtained if the infants are under four months old. For these very young patients success by artificial feeding is not often possible. With those of six months and over, good artificial feeding is very frequently successful. In modifying cow's milk for these cases the formulæ most likely to agree are those with low fat, low proteids—partly peptonized in many cases—and relatively high sugar. Such are obtained by formulæ XV, XVI, and XVII, page 176. Starting with the lower percentages, they may be gradually increased to the highest; then the fat may be increased to that in formula XIII. Further suggestions will be found in the chapter on Feeding in Difficult Cases (page 180). In institutions we are not likely to succeed very often without wet-nurses.

For very young infants, with a temperature which is habitually subnormal, the incubator should be used. If this is impossible, children should be rubbed with oil, rolled in cotton, and surrounded with hot-water bags or bottles. The general management should be much the same as described in the chapter on Malnutrition. At least once every day—by means of spanking, mild flagellation, or, better, by the alternate use of the hot and cold baths—children should be made to cry vigorously, in order to keep the lungs expanded. They require no drugs, but a great deal of careful nursing.

CHAPTER VI.

DISEASES DUE TO FAULTY NUTRITION.

THE diseases due to faulty nutrition are really numerous. There are, however, two which have been so clearly shown to originate in this way that they may be singled out and put in a class by themselves. These are scorbutus and rickets. The prevailing opinion of the medical profession is that both of these are essentially "food-diseases." The purpose of considering them in connection with the disturbances of nutrition is to emphasize this relationship.

SCORBUTUS (SCURVY).

Scorbutus is a constitutional disease, due to some prolonged error in diet. It is characterized by spongy, bleeding gums, swellings and ecchymoses about the joints, especially the knee and ankle, hæmorrhages from the nose, and occasionally from other mucous membranes, extreme hyperæsthesia, and often pseudo-paralysis of the lower extremities. Added to these local symptoms there is usually a general cachexia with marked anæmia. While scorbutus and rickets are very frequently associated, they are not necessarily connected, and can hardly be considered as different forms of the same disease; although cases of scorbutus have been described in older writings under the title of Acute Rickets. The course of the disease is somewhat chronic, lasting for weeks or months; and while it usually yields immediately to proper treatment, if unrecognised and if the original error in diet is continued, it not infrequently proves fatal. It is only within the last twelve or fourteen years that infantile scurvy has found a distinct place in medical literature. For our present understanding of the disease, the profession is indebted chiefly to the work of the English physicians Cheadle, Gee, and Barlow, especially the last named, who in 1883 made a full report upon thirty-one cases of scorbutus in infants and young children, in which publication the etiological factors and clinical history were worked out so fully that but little has since been added to the subject. In Germany it still passes to-day under the title of Barlow's Disease. To Northrup is due the credit of bringing the subject prominently before the minds of the profession of this country.*

Etiology.—Scorbutus is not uncommon in infancy, but it is frequently unrecognised. During the past two years twelve cases have come under my own observation. All of these were under two years of age, as were also all of Cheadle's twenty cases and twenty-five of Barlow's original thirty-one. The great majority of cases occur between the eighth and twentieth months. There is no preference for sex or season. Since the essential cause of scorbutus is dietetic, it may be found in all surroundings. Of the reported cases, the majority have occurred in private practice and among the better classes of society, in the country quite as often as in the city. The previous diet of most of the patients who develop scurvy has been either some of the proprietary foods or condensed milk, or a combination of the two. Scurvy may be induced by the giving of proprietary foods, even when a small amount of cow's milk has been added. In one reported case (Delafield's), scurvy was produced in a child three years old by an exclusive diet of rare meat, continued for three months.

Since the introduction of the practice of heating milk used in infant-feeding, the question has been raised in many quarters whether this may not be a cause of scurvy. I have carefully investigated this question in the records of three institutions in which for five years "sterilized" milk was the standard food for all artificially-fed infants. The number of children under eighteen months who have had this diet is nearly one thousand. During this period but two cases of scurvy were observed, and in neither case had the child been upon a diet of "sterilized" milk. However, I have recently seen in private practice two cases of scurvy in which the cause seemed to be prolonged sterilization at a high temperature —i. e., 212° F. for over an hour. In some of the cases in which the "sterilized" milk is supposed to have been the cause of scurvy, it is undoubtedly the milk-formula employed which was at fault, and not the process of heating. In two patients under personal observation, who developed scurvy while taking "sterilized" milk and a proprietary food, the food was discontinued and the patient recovered, although heating the milk was continued. In four cases observed by Winters no other treatment was employed than the substitution of "sterilized" milk for the previous diet, which in three instances had been proprietary foods. All the patients promptly recovered. In these cases the milk was heated to 212° F.

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* See paper by Northrup and Crandall, New York Medical Journal, May 26, 1894, in which will be found thirty-six tabulated cases.

Scurvy in nursing infants is very rare. In one of Northrup's cases, a fatal one, the foundling was wet-nursed by a woman whose own child thrived. The presumption here was that the scurvy was induced by insufficient food. Southgate* has reported a fairly typical case of scurvy in an infant of fifteen months, who had been nursed exclusively up to that time. The child was rachitic and quite markedly cachectic, but recovered immediately when weaned and placed upon a diet of cow's milk, orange-juice, potato, etc. The probabilities are that in this case the scurvy was due to the poor quality of the breast-milk, coupled with the bad surroundings of the child.

From all the above evidence it would appear that scurvy may be induced by the continued use of any food which either lacks some elements needed for the child's nutrition, or which furnishes them in such a form that the child can not assimilate them. Clinical experience is overwhelming in support of the view that it is the proprietary infant-foods which are most certain to produce scurvy, especially when they form the exclusive diet.

Symptoms.—The following cases illustrate the chief clinical types of the disease:

The most serious form with fatal termination.—A case of extreme marasmus came under observation in the Babies' Hospital, in 1892, in an infant who for two months had been upon an exclusive diet of a well-known proprietary food. At the end of that time there was observed a swelling about the left knee, which slowly increased in size, and was accompanied by an extreme degree of tenderness about the joint. The swelling was diffuse, spindle-shaped, and accompanied by a purplish discoloration of the skin. A little later the gums became spongy and bled easily at the margin of the teeth. In places where the next teeth were expected, the gum was purple and swollen, evidently from submucous ecchymoses. There were very marked cachexia and anæmia. The swelling extended up to the middle of the thigh, and gradually increased in size until the limb was fully four inches in diameter. An aspirating needle was introduced, but only blood was found. The child wasted steadily, and died of exhaustion two months after the appearance of the first symptoms. During the last few weeks slight fever was present.

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* Archives of Pædiatrics, vol. xi, p. 505.

The autopsy in this case showed the typical lesions of scorbutus. The periosteum of the femur was stripped from the bone throughout the lower two thirds of its extent by subperiosteal hæmorrhage. There were also extravasations of blood between the muscles and into the subcutaneous tissue, and to these hæmorrhages the swelling was mainly due. There was complete separation of the lower epiphysis from the shaft. No other bones were affected.

In most of the cases, however, that have come to autopsy other bones also have been involved with lesions of a similar character; the other long bones most frequently affected are the tibia and humerus; of the flat bones, the scapulæ and cranium. Epiphyseal separation may take place near any of the large joints, hæmorrhages may be found between the muscles, in the subcutaneous tissue, and occasionally in the lungs, spleen, and kidney. The lesion in the mouth is a hæmorrhagic gingivitis.

A typical case of the severe form, ending in recovery.—The patient was a boy fourteen months old, of healthy parents and good surroundings, living in a country town near New York. At birth it was said he weighed fourteen pounds. The mother being unable to nurse him, he had been fed exclusively upon condensed milk and proprietary foods. He had never thriven, but the symptoms of malnutrition and anæmia had been the only ones present until four months before coming under observation. The evolution of the symptoms in this case is interesting because it is so typical. There was first noticed tenderness about the ankles, then about the knees, this being so acute that the child screamed whenever the legs were handled, but at other times he gave no evidence of pain. A little later, boggy swellings were discovered about one knee and both ankles. Soon after this the gums were noticed to bleed frequently, and at times they were so much swollen as to conceal the teeth. All these symptoms had continued up to the time the child was brought for treatment. He had been growing gradually worse, each day becoming more anæmic and cachectic. Several attacks of epistaxis had occurred, and once there had been hæmorrhage from the ear. In one of the best general hospitals of New York the diagnosis of ostitis of the knee had been made, and a plaster-of-Paris splint applied.

On examination, the child presented the signs of rickets of moderate severity. There were irregular swellings about the left knee and ankle, but no discoloration of the skin. Slight swelling was seen also upon the lower part of the right leg. The limbs were exquisitely tender, the slightest movement causing the child to scream with pain. It was several months since voluntary movement had been seen, and the legs now lay absolutely motionless, apparently owing to the pain which any attempt at motion excited. The gums were like those in the preceding case, but the condition was more marked, and ulceration was seen along the incisor teeth.

Under treatment exclusively dietetic, the symptoms, which had been unchanged for three months, were wonderfully improved in three days; and at the end of two weeks the child was kicking his legs about, the swelling and tenderness were gone, the gums entirely well, and the general condition greatly improved. The case went on to a rapid and complete recovery.

The mildest type seen without either swellings or mouth-symptoms.— These cases are not often recognised as scurvy, but they are probably the most common form. This child was seen in the country, in private practice. It was an exceedingly healthy infant in appearance, nine months old; the diet from birth had been milk "sterilized" at 170°, with the addition of a well-known infant-food. At the time of his attack he was apparently in the best of health, with bright red cheeks. He was first noticed to cry out sharply as if in pain when lifted in a certain way. It soon became evident that the trouble was located about the left knee. Nothing could be discovered upon examination except a very great amount of tenderness. This symptom continued for six weeks; on some days the tenderness was extremely acute, and on others scarcely noticeable. After three weeks a slight ecchymosis was discovered over the head of the tibia of the affected limb. About this time tenderness and a disinclination to move the right shoulder were noticed, and soon an ecchymosis like a small bruise was seen in front of the shoulder joint. The diet at this time was a liberal amount of milk, a small quantity of the infant-food daily, with beef juice. The ecchymoses about the knee and shoulder, with tenderness, pain, and disability, sufficed for a diagnosis of scurvy, in spite of the fact that the gums were normal, although two teeth were through, and that no swelling existed about the joints. The proprietary food was now discontinued, the amount of beef juice increased, and in three days the symptoms entirely disappeared. No change in heating the milk was made.

I have seen several other cases presenting symptoms in all respects identical with the above, but lacking even the ecchymoses about the joints, which were immediately relieved by dietetic treatment after having lasted from two to six weeks. In none of these cases were the gums affected, but in one there was quite a marked cachexia. There is no doubt in my mind that all these were cases of genuine scurvy of a mild type, and if allowed to go on would have developed the other usual symptoms.

In older children, scurvy is occasionally seen with causes and symptoms more like the adult type of the disease. The symptoms referred to the lower extremities are not so marked. There are swelling and sponginess of the gums with frequent hæmorrhages; the teeth may loosen and fall out; there may even be some sloughing of the gums; the breath is intensely fetid; and hæmorrhages may take place from the kidneys, the bladder, or the stomach. There is a very marked general cachexia, extreme languor, and often syncopal attacks. These cases are usually due to a diet deficient in fresh vegetables, and are most frequent among the very poor.

Diagnosis.—The diagnosis of scorbutus is usually an easy one, as the great majority of cases are fairly typical. The symptoms to be relied upon for diagnosis are:

1. Hyperæsthesia, especially about the knees and legs, which is often very acute. It may be the first symptom noticed. The pain is increased by any motion or pressure, but otherwise does not seem to be present.

2. There is disability or disinclination to move the limbs—usually the legs—which may be so great as to lead to the suspicion of paralysis. This disability is usually due to pain, sometimes to epiphyseal separation. It is similar to the pseudo-paralysis of hereditary syphilis depending upon osteo-chondritis.

3. The mouth is the seat of hæmorrhagic gingivitis. The gums are swollen, bleed easily, and at times cover the teeth. There is ulceration about the teeth which have appeared, and partial discoloration of the mucous membrane over the teeth soon to appear.

4. There are swelling and ecchymoses about the large joints, especially about the knee and ankle. The ecchymoses may be seen in any part of the body.

5. There may be hæmorrhages from the mouth, nose, stomach, bowels, and occasionally from the kidneys. In rare instances hæmorrhage has occurred into the orbit, producing exophthalmus.

6. There are a general cachexia and marked anæmia with flabby muscles, and often the signs of rickets.

7. There is a history of bad feeding, usually of the continued use of some proprietary food.

8. The symptoms are immediately improved and in most instances rapidly cured, by antiscorbutic diet without other treatment. This is perhaps the most diagnostic of all the symptoms.

Scorbutus in infancy is usually mistaken for rheumatism or paralysis; less frequently for rickets, ostitis, and purpura. By close attention to the symptoms above mentioned it is almost impossible to make a mistake in diagnosis.

Prognosis.—This is invariably good if the disease is recognised early. Scarcely any other cases improve with such marvellous rapidity as do these when the proper dietetic changes are made. Complete recovery can usually be predicted in two or three weeks. Death is not an uncommon termination in cases which have been unrecognised. Of Barlow's thirty-one cases seven were fatal. I have seen but one fatal case.

Treatment.—This is remarkably simple: to discontinue all proprietary foods and condensed milk, and give an abundance of fresh cow's milk, beef juice, orange juice or other fresh fruit, and, in cases that are over a year old, potato. In addition, iron and cod-liver oil may be required later, but the essential thing is the change in diet.

The tenderness requires that the child shall be kept as quiet as possible, and its cachexia that it be protected against cold and exposure.

RICKETS (RACHITIS).

Rickets is a chronic disease of nutrition. While the only important anatomical changes are found in the bones, it is not to be regarded as a bone disease; but as a very complex pathological process which affects the bones, muscles, ligaments, mucous membranes, and nearly all the organs of the body, particularly those of the nervous system. It occurs especially between the ages of six months and two years. It is not common in the country, but is exceedingly frequent in most large cities. While not a fatal disease *per se*, rickets adds very greatly to the danger from all acute diseases in infancy, and even to some degree also to those of later life. Under proper conditions of diet and hygiene it tends to spontaneous recovery.

Etiology.—The essential cause of rickets is dietetic, although hygienic influences play a very important rôle in its production. While it seems to be demonstrated that diet alone may produce rickets, nevertheless this condition is much more easily produced when there are also unfavourable hygienic surroundings. Rickets is not common in nursing children unless lactation be unduly prolonged,* as, for example, where nursing is continued for fifteen to eighteen months without other food. Artificially-fed children are much more prone to the disease, especially those who are badly fed. The diet in these cases is usually very deficient in fat, and often at the same time in proteids, while it contains an excess of carbohydrates. It is somewhat difficult to separate the effects which these different conditions produce. It appears, however, that the most important factor is a great deficiency in fat. Rickets is exceedingly common in children reared upon the proprietary foods, nearly all of which are very low in fat and contain an excess of carbohydrates. It is also common in children who are reared upon sweetened condensed milk, and for precisely the same reason. When both fat and proteids are low, rickets is more liable to result than when only the fat is deficient.

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* An exception to this statement must be made in the case of Italian children. In this class as observed in New York it is very common to see marked rickets in those getting nothing but the breast.

Hygienic surroundings are next in importance to diet. Although, as previously stated, rickets is essentially a disease of cities, being principally seen in children living in crowded tenements where the effects of improper food are most strikingly shown, yet even here the disease is rare in those who get a plentiful supply of good breast milk.

Animal experiments.—Bland-Sutton experimented, in the Zoölogical Gardens, London, upon lion whelps. Those which were weaned early and fed solely upon raw meat invariably became extremely rachitic. Two young cubs, fed upon rice, biscuits, and raw meat, died from rickets. Two young monkeys, upon an exclusively vegetable diet, became rachitic. To the young lions who had developed rickets, milk, cod-liver oil, and pounded bones were given in addition to the meat, and in three months, although the hygienic condition of the animals remained unchanged, all signs of rickets had disappeared. Guerin produced typical rickets in puppies which were kept upon a meat diet for four or five months, while others of the same litter, which were suckled, remained in good health. Other animal experiments by various observers with different articles of food have given results that were not uniform. It seems, however, to be pretty positively established, that withholding milk from young animals and putting them upon a diet of meat, vegetables, or starches is sufficient to produce rickets, and that the earlier this is done the more certain is the result. This may occur apart from any change in the hygienic surroundings. These animal experiments strengthen the opinion above given, that the essential cause of rickets is improper food, and that the element most uniformly lacking is fat.

Distribution of rickets.—According to Palm, the disease is almost unknown in the extreme north—Greenland, Iceland, Norway, and Denmark. It is also very rare in China, Japan, Greece, Turkey, and the southern portions of Italy and Spain. Its greatest frequency is in the temperate zone. The general immunity of children in southern climates appears to be due to the out-of-door life, and the almost universal custom of maternal nursing. In the cities of America no race is exempt from the disease. In New York the greatest susceptibility is among the Negroes and the Italians. Extreme cases of rickets are almost invariably in one of these nationalities. It is exceptional to see in a dispensary or hospital a child of either of these races who does not show, to a greater or less degree, the signs of rickets. These two southern races seem to bear very badly the climate and the confined life of the northern cities. So far as my observations are concerned, there is no peculiarity in the food of these people which explains the prevalence of rickets among them, and this must be attributed to a race peculiarity. In the country, the immunity from rickets is due partly to the more prevalent custom of maternal nursing, and partly to the better surroundings; the increased resistance of the children rendering them much less susceptible to the influences of bad feeding than those of the cities. In New York among dispensary and hospital patients, rickets is exceedingly common, and is seen in all nationalities, although chiefly in the foreign elements of the population.

Heredity.—There is no evidence that rickets is a hereditary disease. Any cachexia in the parents, such as syphilis, tuberculosis, or alcoholism, may, however, by diminishing the child's resistance, be a predisposing cause of rickets. The later children in a family are more likely to be affected than the earlier ones, especially when the intervals between the pregnancies has been short, or where anything else has caused a deterioration in the general health of the mother.

Previous disease.—Rickets not infrequently develops in syphilitic children; the connection, however, seems to be no closer than to any other cachexia. The relation of rickets to other diseases, particularly with those of the digestive tract, is very much less intimate than one would expect. Acute diseases of the stomach and intestines are very frequently followed by marasmus, but only exceptionally by marked rickets. There is no sufficient ground for believing that rickets exerts any protective influence against tuberculosis, as has been asserted. In fact the thoracic deformity of rickets may be a predisposing cause to tuberculosis.

Rickets affects both sexes with equal frequency. The symptoms usually manifest themselves between the sixth and fifteenth months. Congenital and late rickets will be considered separately.

Rickets is therefore a complex disease of nutrition, whose exact pathology has not yet been definitely settled. It is more difficult to believe that the general nutritive disturbances are the result of the bone changes, than to regard both as having a common origin. Kassowitz regards the bone changes as inflammatory, excited by the presence of some irritant. The irritant has been believed by many to be lactic acid, originating in the digestive tract; but the evidence in support of this theory is not conclusive. It is very doubtful whether the process is as simple as the formation of lactic acid in the intestine and its circulation in the blood. It is, however, clear that it is something which interferes with the assimilation of the lime salts. At the present time, the disposition is to regard rickets as a disease of nutrition, which may be produced in animals by certain dietetic changes. In infants, it seems to be settled that it may be produced by similar changes in diet, aided very greatly, however, by unhygienic surroundings. The effect of these abnormal conditions is shown upon the whole organism, but the only constant and regular anatomical changes are in the bones. These osseous lesions resemble those of chronic inflammation. Precisely how the dietetic and other causes produce the bone changes is still a matter of speculation. The constancy of bone changes in rickets give it a place as an essential disease, and not merely a form of malnutrition.

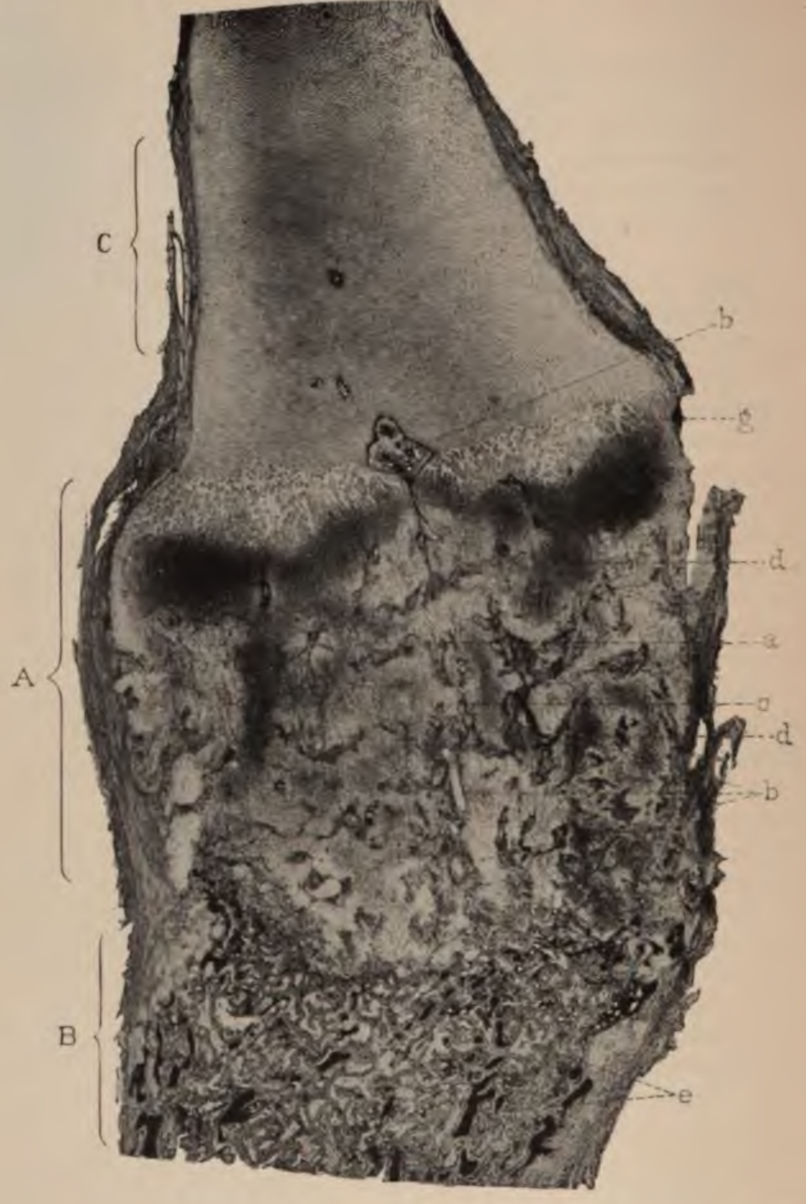
Lesions.—The only constant and characteristic lesions of rickets are found in the bones. It is still a matter of dispute whether these bony changes are to be considered as inflammatory, or simply as the result of disordered nutrition. Perverted nutrition and chronic inflammation are closely allied, and it really makes but little difference which view is taken. Occurring at a time when the growth of bone is so rapid, the effects of rickets are very striking and very serious.

In order to appreciate how bones are affected by rickets, it must be remembered that the long bones grow in length by the production of bone in the cartilage between the epiphysis and the shaft; that the shaft grows in thickness by the production of bone beneath the inner layer of the periosteum; and that the medullary canal is continually increasing in size by the absorption of the inner layers of the bone. In rickets there is an exaggerated production of cartilage at the epiphysis, and excessive cell-growth beneath the periosteum, while the process of ossification in these tissues goes forward slowly and imperfectly, or is entirely arrested. At the same time the absorption of the medullary layers may be even more rapid than normal. In health the growth of bone in length is much more rapid than its increase in diameter, owing to the greater activity of the changes taking place at the epiphysis; so, in rickets, it is at the extremities of the long bones that the most marked changes are seen.

One of the most striking features of rachitic bones is their unnatural flexibility. This is due to deficient ossification in the superficial layers of the shaft of the long bones, and also at their extremities. Normally, bone contains about one third organic and two thirds inorganic matter. In marked rickets the proportions are reversed, the bones often containing twice as much organic as inorganic matter. Changes are seen in all the long bones, but all are not affected to the same degree. Sometimes those most affected will be the bones of the leg, sometimes those of the forearm, and sometimes the ribs. The extent varies with the severity of the process.

There are characteristic changes in form. The most constant is enlargement of the epiphyses of all the long bones. This is most strikingly seen in the lower extremities of the radius and tibia. The enlargement may be so marked that the width of the epiphysis is increased by one half its diameter. All the sharp angles, borders, and prominences of the bones are rounded off. The curvatures of rachitic bones are more fully described under the symptoms. They may be due to a variety of causes. Some are simply an exaggeration of the normal curves, much increased by the swelling of the epiphyses; others are due to muscular action, to atmospheric pressure, to some unnatural posture, such as the cross-legged position, to the weight of the limbs, or to the weight of the body. The principal change in the form of the flat bones consists in the production of large bosses or prominences due to thickening of the bone, usually about the centre of ossification. These bosses are soft and spongy. Frac-

PLATE IV.



BONE IN RICKETS.

Longitudinal section of a rib at the junction of the costal cartilage, in a severe case of rickets (slightly magnified). C = costal cartilage, B = bone, A = proliferating cartilage-zone, which is much widened. Between the hypertrophied cartilage cell-columns (*a*) making up this proliferating zone, are seen medullary spaces (*b*) containing blood-vessels. In this zone lie masses of bone (*c*) not calcified. The calcification zone is almost wanting, only scattered islands (*d*) of calcified cartilage-cells being seen.

Beyond this proliferating zone (A) is a layer of bony tissue (B) made up of small bands of which only a few have a nucleus containing lime (*e*). These nuclei appear black. The bony bands differ both in form and arrangement from those of normal ossification. Between the bony masses are medullary spaces which appear light in the illustration. At (*g*) the beginning of cartilage proliferation is seen. Above this zone the cartilage is normal. (From Karg and Schmorl.)

tures are not uncommon. The bones most frequently broken are the radius and ulna; next, the clavicle or the ribs. The fractures are usually of the green-stick variety. There is a bending of the outer and a fracture of the inner layers of the shaft of a long bone. This results in more or less impaction, and is usually followed by the production of considerable callus. The epiphyseal changes result in arrested growth in length, rachitic bones being usually much shorter than normal. Increased vascularity is seen in the bosses upon the flat bones, at the extremities of the long bones and upon stripping the periosteum from the shaft.

In a longitudinal section of one of the long bones, the principal change seen at the extremity is that the cartilaginous layer which unites the epiphysis and the shaft is very much enlarged, both in width and thickness, the latter being sometimes four or five times the normal. This cartilaginous area is of a bluish colour, rather softer than normal cartilage. On one side it blends with the cartilage of the epiphysis, on the other it presents an irregular dentated border, and in it the calcified areas are irregular and scattered. The epiphyseal centres of ossification are enlarged, softer, and more vascular than normal, thus increasing the size of the extremity of the bone. In the shaft, the outer layers of bone are thickened and soft, like decalcified bone, the deeper parts being firmer, while the deepest layers may be completely ossified. The medullary canal is much more vascular than normal, its contents resembling granulation tissue. Toward the extremities the trabecular spaces are much increased in size, so that the bone appears unnaturally porous. On vertical section of one of the flat bones—e. g., one of the bosses upon the skull—there is found a great increase in the size of the trabecular spaces. The bosses are made up of large spongy masses, so soft as to be easily indented with the finger, and on pressure there oozes blood and serum in a considerable quantity.

Microscopical changes.—At the junction of bone and cartilage at the extremity of one of the long bones, there are readily traced in normal bone (Fig. 32) several distinct zones. Next to the hyaline cartilage (*a*) there is a proliferating zone (*b*), made up of cartilage cells and matrix, the cells having no orderly arrangement. Next to this is a columnar zone (*c*, *d*), in which the cartilage cells are arranged in regular rows or columns. Adjoining this is the zone of calcification (*e*); and, finally, there is the zone of ossification (*f*, *g*), where true bone is formed.

In rickets (Plate IV and Fig. 33), the principal changes are seen in the proliferating and columnar zones. The proliferating zone (Fig. 33, *b*) is increased chiefly by the multiplication of new cells; it is also more vascular than normal. The columnar zone (*c*) is affected in a similar way and to a much greater degree. It is less regular in its formation, and, instead of containing but few vessels, it shows large vascular channels, sometimes surrounded by medullary spaces (*e*). The ossification zone, instead of being narrow and sharply outlined, is broad and very irregular.

Calcified areas (*f*) may be seen in the midst of regions which are cartilaginous, while masses of cartilage (*h*) occupy areas which should be completely calcified. In some places there appears to be a transformation of cartilage into bone-tissue of an inferior sort by a direct or metaplastic process. In the shaft there is seen more or less thickening, and an increased vascularity of the periosteum. Beneath the inner layer there is excessive cell-proliferation, while calcification of this new tissue is imperfect or absent, and instead of hard, compact bone, we find irregular, spongy masses. In the spongy bone there is considerable thickening, with an erosion of bony trabeculæ, which results in the formation of large medullary spaces filled with blood-vessels and connective tissue rich in cells.

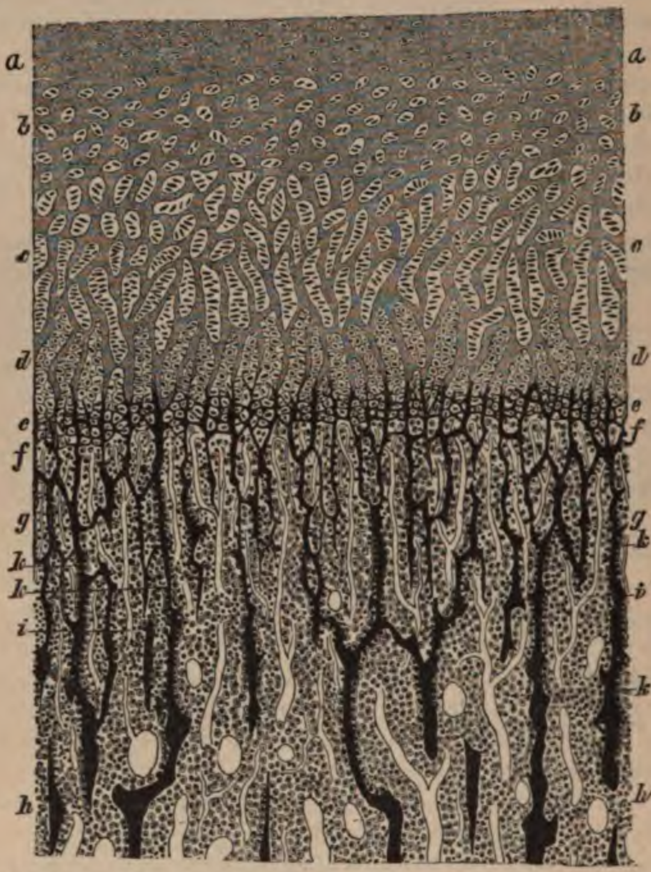


FIG. 32.—Section through ossification zone of normal bone (Ziegler). *a*, hyaline cartilage; *b*, zone of beginning cartilage proliferation; *c*, columns of cartilage cells; *d*, columns of hypertrophic cartilage; *e*, zone of temporary calcification; *f*, zone of primary medullary spaces; *g*, zone of primary bone formation; *h*, fully developed spongy bone; *i*, blood-vessels; *k*, layer of osteoblasts.

Termination of the rachitic process.—After a variable time, usually from three to fifteen months, the active proliferative process going on in the cartilage and beneath the periosteum ceases, and is gradually replaced by ossification. The bone becomes less vascular, and a rapid formation of bone takes place in the normal way. In addition, there is in some places a direct transformation of cartilage into bone. Condensation and

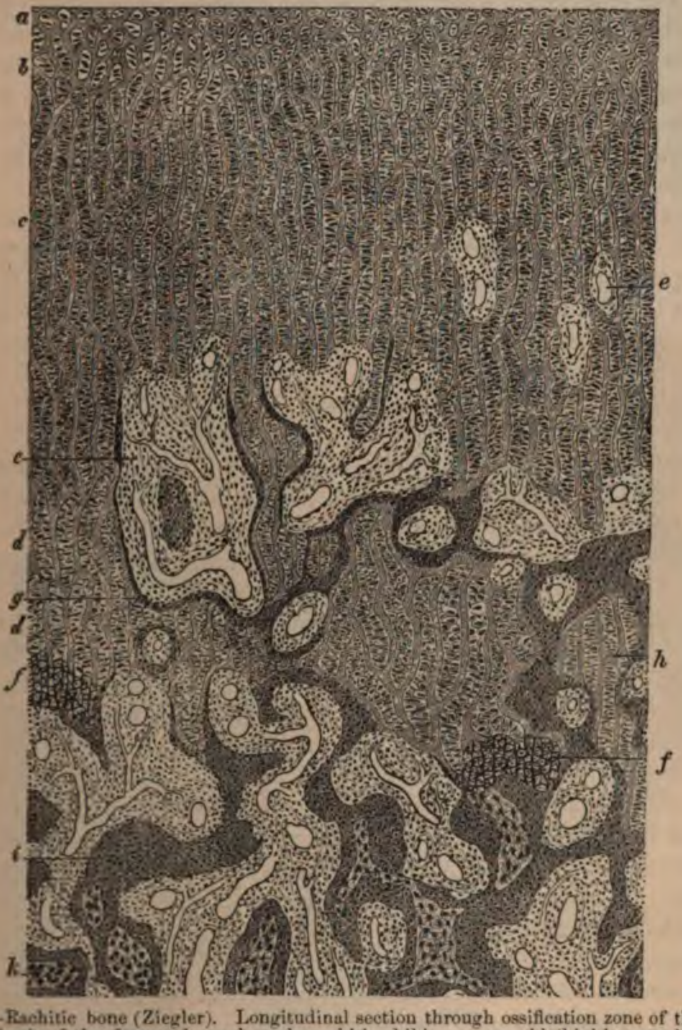


FIG. 33.—Rachitic bone (Ziegler). Longitudinal section through ossification zone of the upper diaphysis of the femur of a moderately rachitic child one year old (highly magnified). *a*, unchanged hyaline cartilage; *b*, beginning cartilage proliferation; *c*, columns of proliferated cartilage cells; *d*, columns of proliferated hypertrophic cells; *e*, medullary spaces containing blood-vessels lying within the cartilage; *f*, calcified cartilage; *g*, bony tissue; *h*, remains of cartilage within the bony tissue; *i*, point of uncalcified bony tissue; *k*, calcified bony tissue.

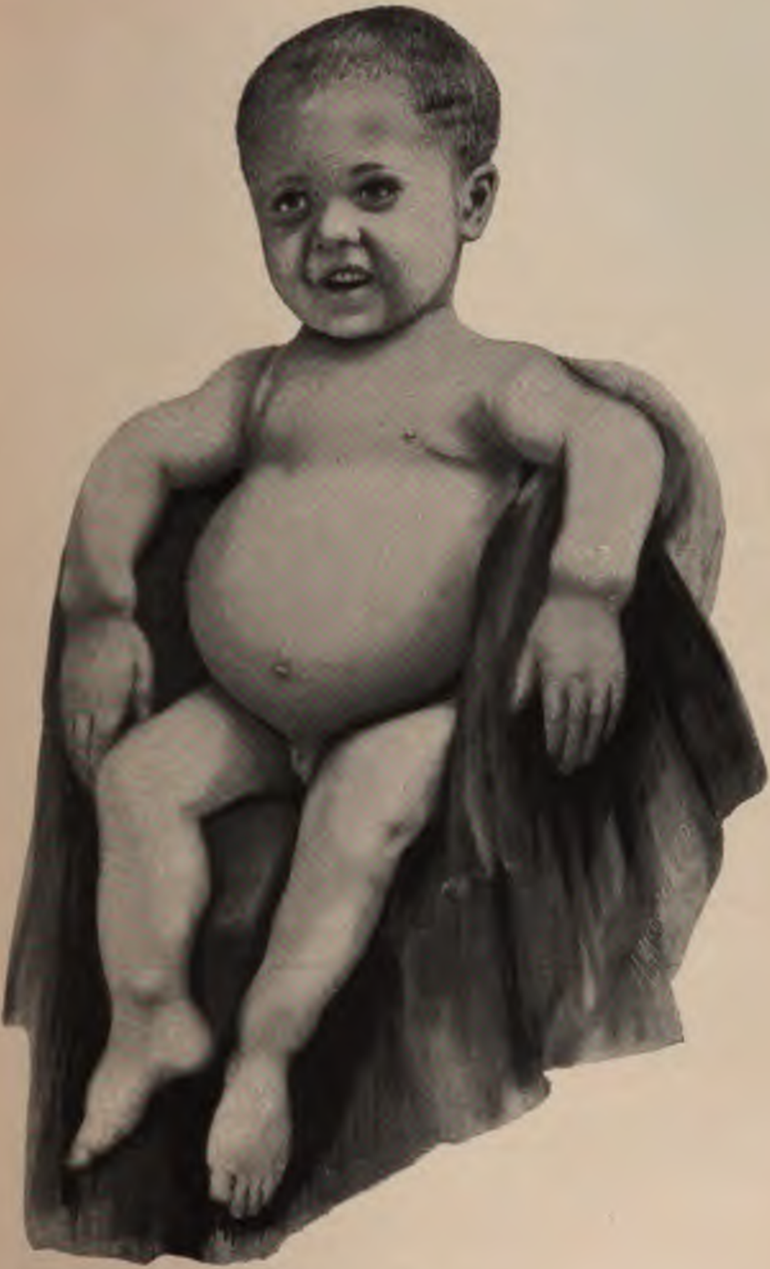
contraction take place in the spongy masses of bone. As the result of this, the affected bone may become even harder than normal; often it is ivory-like. Its structure, however, is never quite like that of healthy bone.

In the long bones the epiphyseal swellings slowly diminish, and may quite disappear; the slighter curvatures may be entirely overcome, and the greater ones much lessened. The beading of the ribs becomes almost imperceptible; the bosses upon the skull shrink very markedly, and may leave scarcely a trace of their existence. In most cases the active process in rickets has come to an end by the time the child is two and a half years old, often at two years.

Visceral lesions.—These are not infrequent, but are not essential to rickets. In the lungs they are due to deformities of the chest wall and to complications. Beneath the deep lateral furrows which are so common, there is found a part of the lung in a state of more or less complete collapse. This is accompanied by emphysema of the portion just anterior to it. Acute and chronic bronchitis and broncho-pneumonia are exceedingly frequent. A low grade of chronic catarrhal inflammation in the stomach and intestines is common, and is often associated with dilatation of these organs. The spleen is enlarged in most cases during the period of active symptoms. This is usually moderate in degree, although marked enlargement is not at all rare. The swelling of the spleen is due to simple hyperplasia, and not to amyloid degeneration. Enlargement of the liver is less frequent, and may occur with or without that of the spleen. There are no constant changes in the structure of these organs. The lymph nodes (lymphatic glands) are frequently enlarged. Rachitic patients are more prone to these swellings than are other children. They are due to simple hyperplasia, and have no close connection with rickets. Cerebral changes are rare, and those described are rather of accidental occurrence than dependent upon the rachitic process. As stated under Symptoms, enlargement of the head is usually due to thickening of the cranial bones. Although hydrocephalus is occasionally seen, it is extremely doubtful whether it is more frequent than in patients not rachitic. Hypertrophy of the brain has been described in connection with rickets, but as yet this does not seem to be established by sufficient pathological evidence. The muscles are flabby from imperfect nutrition, and sometimes atrophied from disuse, but no essential anatomical changes have been demonstrated in them.

Symptoms.—A well-marked case of rickets makes a striking picture (Plate V), and one not easily mistaken. There are seen the large head, beaded ribs, narrow chest, prominent abdomen, symmetrical swellings of the epiphyses of the wrists and ankles, and curvatures of the extremities. The beginning of symptoms is nearly always insidious, and the patient does not usually come under observation until they have existed for several weeks, often several months.

PLATE V.



Typical Rickets.

Showing the large head, narrow chest, prominent abdomen, marked enlargement of the epiphyses at the wrists and ankles. There are also curvatures of the forearms and legs which are not so well shown.

The patient a child two and a half years old.

Early Symptoms.—The most constant early symptoms are sweating of the head, extreme restlessness at night, constipation, beading of the ribs, and cranio-tabes. The head-sweating is rarely absent, and may continue for several months. It is especially profuse during sleep, the perspiration standing out in large drops upon the forehead, often being sufficient to wet the pillow. This is one of the causes of the nasal and bronchial catarrhs so common in rachitic infants. There is marked restlessness during sleep: the children tossing about the crib, kicking off the clothes, and never having the quiet, natural slumber of healthy infants. This may be due to many causes, but when persistent and associated with marked perspiration of the head, rickets should be suspected. Constipation is frequently seen as an early symptom, although it is more marked in the later stages of the disease.

The beading of the ribs is almost invariably the first appreciable change in the bones, and it is well-nigh constant. This forms the so-called "rachitic rosary," consisting of nodules at the line of junction of the costal cartilages and the ribs. It may be slight, or there may be a row of knobs as large as small marbles. In many cases with marked thoracic deformity, little or no beading of the ribs is seen externally, although at autopsy it is found to be very marked upon the internal surface of the chest (Plate VI). Beading of the ribs was noted in all but two of one hundred and forty-four successive cases of rickets, at the time of the first examination. In infants under six months there may be found soft spots in the cranium, usually over the occipital or posterior portions of the parietal bones. These are from one fourth to one inch in diameter, and there are usually several of them present. By pressure with the finger they give a sort of parchment-crackling sensation. They are known as cranio-tabes. In my own experience this has not been a frequent symptom. Cranio-tabes is more frequently seen when syphilis is associated with rickets, and it is seen also in syphilitic cases which are not rachitic. The rachitic cachexia is not usually present until the symptoms have existed for several months, and in many cases it is not seen at all.

Deformities.—The deformities of rickets are almost invariably symmetrical in character, and usually numerous. In extreme cases almost every bone in the body is affected.

Head.—This usually appears to be too large, and although it may not be greater in circumference than that of a healthy child of the same age, it is out of proportion to the rest of the body. In marked cases the increase in circumference may be nearly two inches. The enlargement is in most cases due to thickening of the cranial bones. In one case with marked deformity, I found the skull over the parietal bones half an inch in thickness (Fig. 34). This thickening diminishes with recovery, but in most cases the head remains throughout life larger than it should be. The shape of the rachitic head is somewhat square (Fig. 35), owing to the formation of large bosses over the parietal and frontal eminences. It is flattened at the occiput from pressure, and flattened also at the vertex. In extreme cases, the prominences upon the frontal and parietal bones may be so great as to produce quite a marked furrow along the line of the sagittal and frontal sutures, and one at right angles to this along the coronal suture (Fig. 36). This condition gives unusual prominence to the forehead. Marked deformity of the head has been observed in thirty-three per cent of my cases. The sutures may remain open for an unnatural time, occasionally until the end of the first year. The fontanel is late in closing, being frequently found open at two and a half, and sometimes even at three years. Often at eighteen or twenty months the fontanel is two inches in diameter. The veins of the scalp are often prominent, and the hair is frequently worn from the occiput, owing to restlessness during sleep. Occasionally rickets and hydrocephalus are associated, but this is the least frequent of all causes of enlargement of the head.

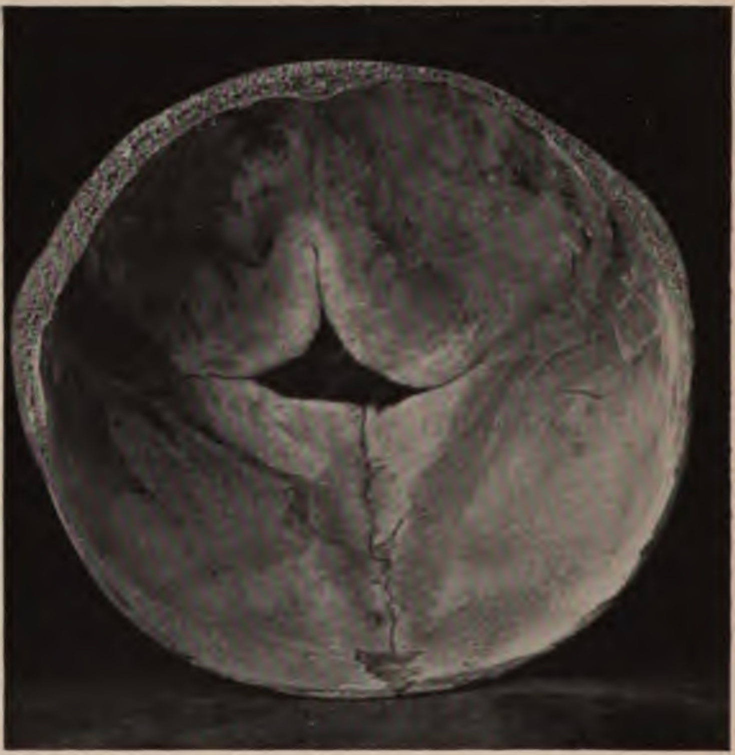
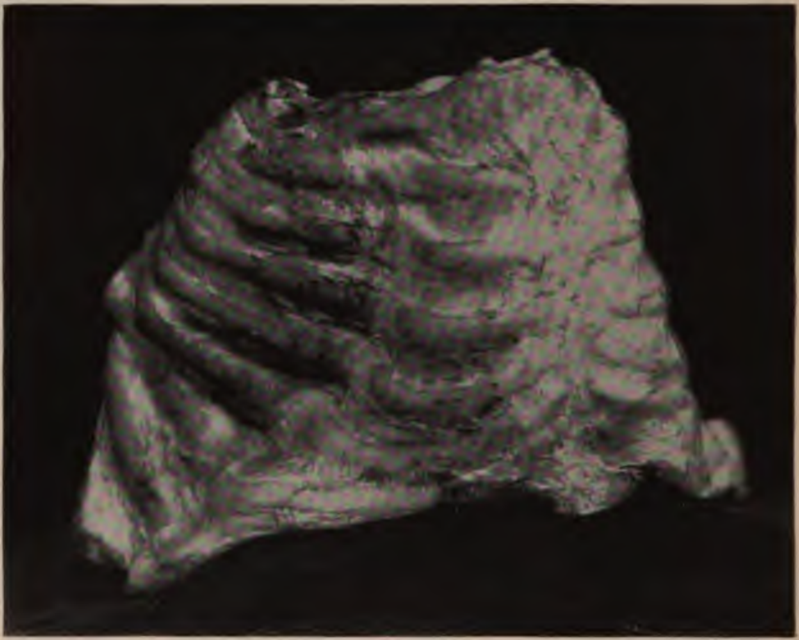
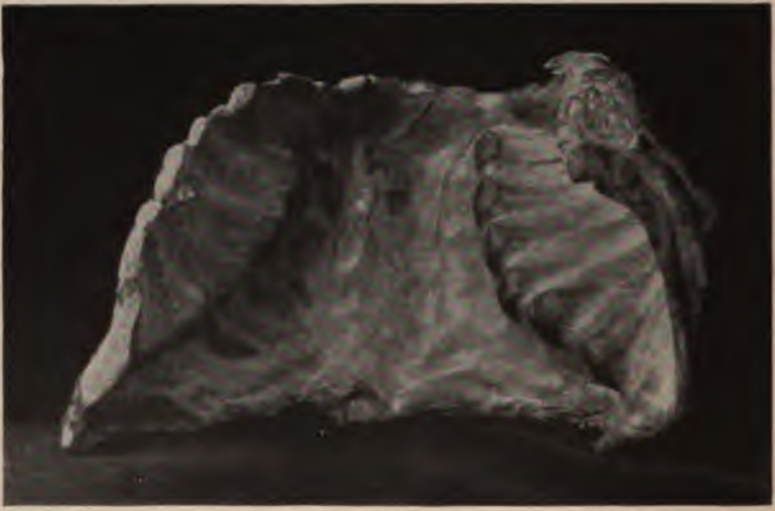


FIG. 34.—Rachitic skull from colored child two years old, horizontal section, inner surface; showing thickening of the bones, especially the frontal, and open fontanel.

PLATE VI.





DEFORMITY OF THE CHEST IN SEVERE RICKETS.

In the upper picture, giving the external view, is shown a deep oblique furrow at the junction of the ribs and costal cartilages, these meeting at an acute angle.

In the lower picture the ribs have been separated from the spine and spread open, showing the same deformity as it appears from within, looking forwards.

From a coloured child ten months old.

Chest.—Beading of the ribs has already been mentioned. This is the most characteristic feature, but in the majority of cases there are, in addition, lateral depressions over the lower third of the chest, at the line of junction of the cartilages with the ribs, with eversion of the lower borders of the ribs. In severe cases these depressions or furrows are so great as to cause serious deformity (Plate VI). Usually there is a great diminution in the transverse and an increase in the antero-posterior diameter of the chest. Fig. 37 shows the outline of the chest of a rachitic child of two years, compared with that of a healthy child of the same age. Another frequent deformity is the "rachitic girdle," which consists in a transverse depression about two inches broad, extending from one side of the chest to the other, just above its lower border. A less frequent one is a deep circular depression over the ensiform cartilage. This is sometimes nearly an inch and a half in depth. Marked thoracic deformity was seen in twenty per cent of my cases, but in only a small proportion was the chest normal.

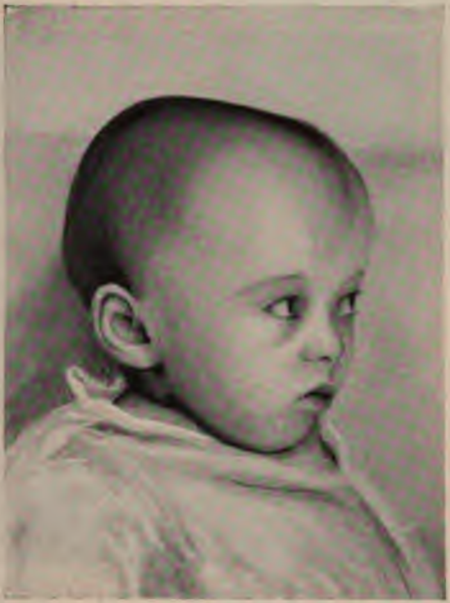


FIG. 35.—Rachitic head; Italian child two years old; square, prominent forehead and flat vertex.

The factors in the production of the thoracic deformity are atmospheric pressure and soft chest walls, these sinking in at the point where they have least resistance, viz., at the junction of the costal cartilages and the ribs. When there is any obstruction to the entrance of air, as in bronchitis, hypertrophied tonsils, or adenoid growths of the pharynx, the thoracic deformities are exaggerated. Irregular chest deformities depend upon the coexistence of pathological conditions in the lungs. Pigeon-breast is occasionally seen, but it is doubtful if this depends upon rickets alone.

Spine.—In very many of the milder cases this is normal. The most characteristic deformity consists in a posterior curve (kyphosis), which is a general one, usually extending from the mid-dorsal to the sacral region. This existed in forty-six per cent of my cases. In the early part of the disease it disappears entirely on suspending the child, or making extension upon the extremities; but in cases of long standing it may not disappear entirely by these tests. Very much less frequently there is seen a rotary curvature. This, in my experience, has been more frequently to the left side than to the right—the opposite of the common form of lateral curvature seen in young girls. Marked lateral curvature in children under three years is usually rachitic.

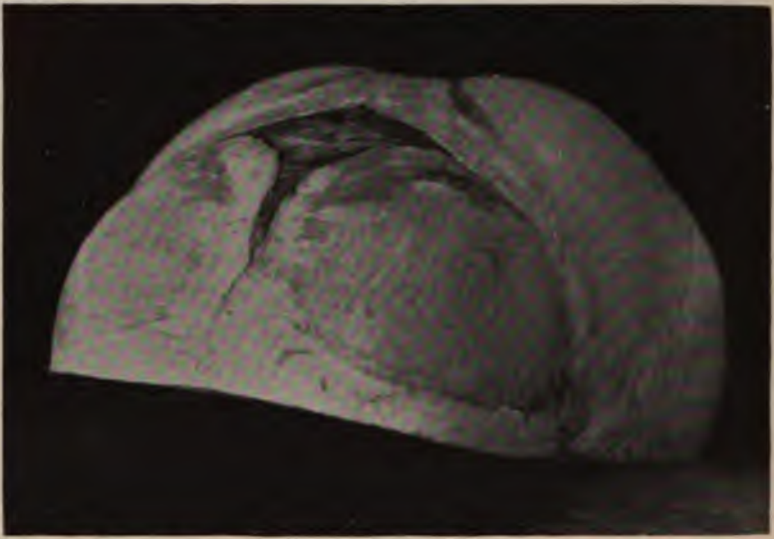


FIG. 36.—Rachitic skull from child one year old, showing frontal and parietal bosses and wide fontanel.

The clavicle is affected only in severe cases. The usual deformity consists in an exaggeration of the anterior curve at the inner third of the bone, which is somewhat shortened and its extremities enlarged. It is not infrequently the seat of green-stick fracture.

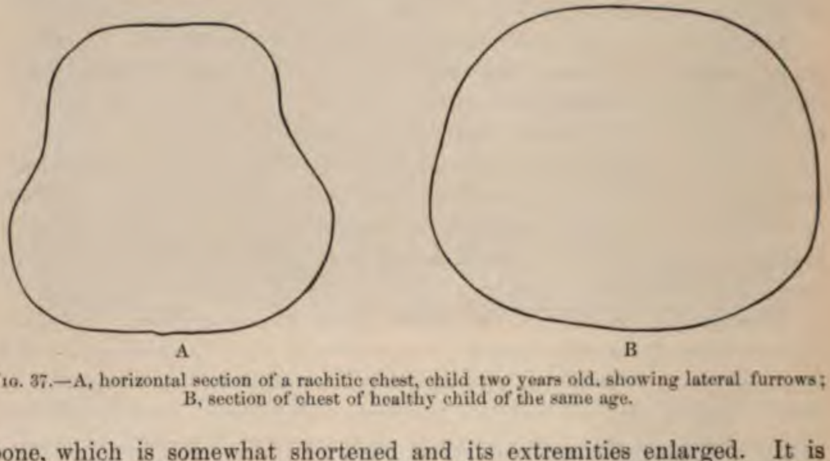


FIG. 37.—A, horizontal section of a rachitic chest, child two years old, showing lateral furrows; B, section of chest of healthy child of the same age.

Deformities of the pelvis belong to obstetrics rather than to pædiatrics. The most common rachitic change is a diminution of the antero-posterior diameter and a narrowing of the subpubic arch. Irregular deformities, sometimes described as "crumpling of the pelvis," are not infrequent.

Extremities.—Deformities of the upper extremities are usually symmetrical. The humerus is affected only in severe cases. It has a forward and outward curve, although rarely a very marked one. Both the epiphyses are enlarged, although the upper one can not often be made out unless the child is very thin. The radius and ulna are frequently affected. They present a convexity upon their extensor surface (Plate V), which in some cases is very marked, particularly in children who have been creeping about. Green-stick fractures here are quite frequent. Rachitic changes at the epiphyses are more common than in the shaft, enlargement of the epiphyses at the wrist being one of the most constant bony deformities of rickets (Plate V). It was present in ninety-five per cent of my cases. Less frequently similar swellings are seen at the elbow. Enlargement of the ends of the metacarpal bones or the phalanges I have seen in but two or three extreme cases.

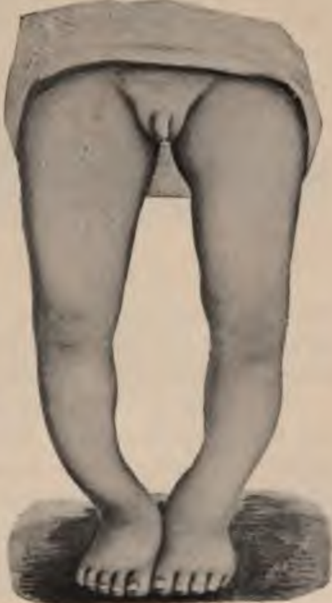


FIG. 38.—Typical bow-legs of severe form.

The lower extremities are rather more frequently affected than the upper, but in a similar way. The femur is involved only in severe cases; it commonly presents a general forward and outward curve, which is mainly due to the weight of the legs as the child sits. Occasionally there is also an outward rotation of the femur, where children have been allowed to sit much in a cross-legged posture. When such children begin to walk, the toes are turned very far outward. The principal deformities of the lower extremity are bow-leg (Fig. 38) and knock-knee (Fig. 39). Knock-knee is more common in females, and is believed to be due to an overgrowth of the inner condyle of the femur. Enlargement of both condyles can be demonstrated in most of the marked cases of rickets. The cases of slight bow-leg may be due simply to swelling of the epiphyses, the shaft of the bone being quite normal. This point I have verified by post-mortem observations. Such are probably most of the deformities which disappear spontaneously. The most severe cases of bow-leg are often associated with some degree of antero-posterior curvature, and the latter may be the principal deformity. An exaggerated case of this kind is shown in Fig. 40. Enlargement of the epiphyses at the ankle is usually present when it is seen at the wrists, and nearly to the same degree. Enlargement of the upper epiphyses of the tibia and the fibula is seen only in severe cases. The cause of the deformities of the leg is not, primarily at least, walking too early, since they are common in children who have never walked; slight deformities, however, may be aggravated by early walking. A change which has not been sufficiently emphasized is the arrested growth of the long bones; this is one of the most characteristic features of rickets. A rachitic child of three years often measures in height six or eight inches less than a healthy child of the same age, the difference being almost entirely in the lower extremities.

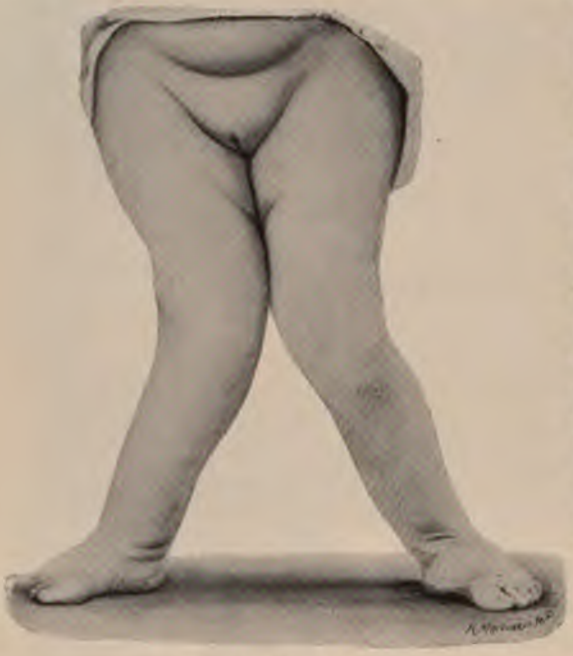


FIG. 39.—Knock-knee.

All the *ligaments*, but particularly those about the large joints, are lax and frequently elongated. This may lead to the deformity known as weak ankles, or to an over-extension at the knee (*genu recurvatum*); also to unnatural mobility at the hips, shoulders, elbows, and wrists. The condition of the ligaments plays an important part in the production of spinal deformities.

Muscles.—The muscular symptoms of rickets are almost as constant and as characteristic as those of the bones. The muscles are small, very flabby, and poorly developed; hence rachitic children are unable to sit erect, or to stand or walk at the proper age. Of one hundred and fifty-one cases in which the date of walking alone was investigated, only twenty-seven, or eighteen per cent, walked before the fifteenth month; forty-seven per cent were not walking at the eighteenth month; twenty per cent not at two years; and ten per cent not at two and a half years. Late walking is one of the most common symptoms for which advice is sought by parents with rachitic children. The muscular power in the extremities is sometimes so feeble as to suggest paralysis. I have seen a number of cases in which the symptoms so resembled paralysis, that even expert diagnosticians were unable to differentiate rickets from poliomyelitis except by the electrical reactions, those in rickets being usually normal or exaggerated. In other cases the symptoms may suggest cerebral palsy of the flaccid type. The muscular symptoms may be marked when the bony changes are slight, and conversely. As no lesions of the muscles have been demonstrated, the symptoms are probably due to imperfect nutrition. Two other symptoms depend chiefly upon the condition of the muscles, viz., pot-belly and constipation.

Pot-belly is quite an early symptom, and in most cases a very marked one (Plate V). It was noted in sixty per cent of my cases. The enlargement of the abdomen is uniform. It is everywhere tympanitic, and it may be as tense as a drumhead. It is due to a loss of tone in the abdominal muscles, and in the muscular walls of the stomach and intestine. It is aggravated by chronic indigestion and consequent intestinal putrefaction. The enlargement is thus mainly from tympanites. There may be a marked degree of dilatation both of the stomach and the colon. To a very small degree only, does the large abdomen depend upon swelling of the liver or spleen.

The constipation of rickets, as already hinted, depends upon the loss of tone in the muscular walls of the intestines. It may alternate with diarrhœa. It rarely happens that a rachitic child has habitually normal evacuations from the bowels. Hard, dry, constipated stools frequently set up a condition of chronic catarrh of the colon in which large masses of mucus are discharged.

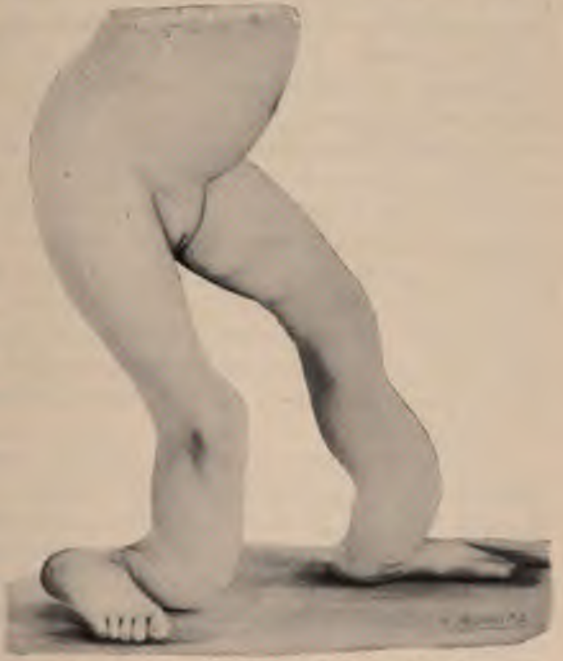


FIG. 40.—Extreme rachitic deformities of the legs.

During the most active part of the disease—viz., from the third to the ninth month—*tenderness* may sometimes be elicited by pressure upon the epiphyses. This, however, is not a constant symptom, and a very unreliable one for diagnosis. In my own experience it has been marked in but a very small proportion of the cases. Acute tenderness should always suggest scurvy rather than rickets.

Fever.—According to some observers there is a febrile movement which belongs to the active stage of rickets, but I have never been able to satisfy myself of the truth of this observation.

Dentition.—As a rule, dentition is late and apt to be difficult—i. e., it is associated with attacks of indigestion or other disturbances which may be serious. Individual cases, however, present great variations in regard to this symptom. A study of the progress of dentition in one hundred and fifty rachitic children gave the following results: in fifty per cent the first teeth were cut on or before the eighth month, and in thirteen per cent on or before the fifth month; however, twenty per cent of the cases had no teeth at twelve months, and in eight per cent none had appeared at fifteen months. Even though the first teeth come at the usual time, the progress of dentition is often arrested by the development of rickets, and no advance made for five or six months. The difference in the cases appears to depend very much upon the age of the child when rickets begins. Those who give no evidence of it until nine or ten months old often have a nearly normal dentition, while the cases developing early show a marked retardation of this process. The order in which the teeth appear may be very irregular, but there is no rule in this respect. The character of the teeth in rickets, in the great majority of cases, is good. This was true in eighty-four per cent of one hundred and twenty-six cases examined with reference to this point. This is in striking contrast to hereditary syphilis, where the tendency to early decay is so constantly seen.

General appearance.—Rachitic patients are almost always anæmic. The blood is low in hæmoglobin, often down to thirty or forty per cent. In some few cases there is in addition quite marked leucocytosis. The number of red globules is not often nor uniformly affected. The majority of rachitic patients are fat and flabby. The tissues are soft and have but little resistance. Rarely, they may be thin, like patients suffering from marasmus.

Rachitic patients are very prone to suffer from hypertrophied tonsils, adenoid growths of the pharynx, and enlargements of the lymph nodes of the neck. In all forms of acute illness the feeble resistance of these patients is very evident. This is especially true of acute disease of the lungs.

The *mucous membranes* are very vulnerable in all rachitic patients. From the slightest indiscretion in diet an attack of acute indigestion or diarrhœa is brought on, and from a very insignificant exposure, catarrhal inflammation of the upper or lower air passages is excited. In rachitic patients all such attacks are prone to run a protracted course. Inflammation of the trachea and larger bronchi is liable to extend to the smaller bronchi and the lungs.

The downward displacement of the *liver* and *spleen* from contraction of the chest should not be mistaken for enlargement of these organs. Moderate enlargement of the spleen is very common during the stage of most active symptoms—i. e., sixth to twelfth month. Great enlargement of either liver or spleen is infrequent, and when present it is doubtful whether it depends upon the rachitic process. It is rather to be connected with the condition of the blood which is developed during the disease.

Urine.—There are no recent studies of the urine of rachitic patients which are reliable.

Nervous symptoms are among the most frequent manifestations of rickets. Restlessness at night has already been mentioned as a prominent early symptom. Pain and tenderness are rare. A disposition to muscular spasm is seen in many cases. There may be laryngismus stridulus, tetany, or general convulsions. The first two are rare except in rachitic patients. All of these probably depend upon defective nutrition of the nervous centres. While in all infants, owing to the irritability of the nervous centres, convulsions are easily excited from relatively slight causes, in those who are rachitic this susceptibility is greatly intensified. In them, slight causes are sufficient to bring on either local or general convulsions. As a predisposing cause of convulsions in infancy, rickets takes the first place. The younger the child and the more active the rachitic process, the more frequently do convulsions occur. They belong especially to the first year, being most frequent between the third and ninth months. The exciting cause of convulsions in these cases is usually to be found in the stomach or intestine.

Course and termination.—Rickets is essentially a chronic disease, and its course is measured by months. The active symptoms in most cases continue from three to fifteen months, although they occasionally last a much longer time. The duration of the symptoms probably depends chiefly upon the duration of the exciting cause. That active symptoms cease when a child reaches the age of eighteen months or two years, is no doubt due chiefly to the fact that at this age the diet is more general, and is more likely to furnish what the child needs, and that more fresh air is likely to be secured than at an earlier age.

The earliest symptoms of improvement are a diminution in the nervous symptoms, especially in the restlessness at night; increased muscular power, as shown by disposition to stand or walk; diminution in the head-sweats; disappearance of the cranio-tabes; and improvement in the anæmia. The changes in the deformities are very slow, and from month

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to month almost imperceptible. When improvement once begins, however, it usually goes steadily forward, relapses being exceedingly rare.

Congenital rickets.—Infants may present at birth the characteristic deformities of rickets, and there may be found even the minute bone changes of the disease. Such cases are reported to be common in Vienna and other large cities of Europe, where mothers during pregnancy have lived under unfavourable surroundings. In America, however, congenital rickets is a very rare disease. Single cases have been reported by Jacobi, J. Lewis Smith, and lately by Townsend. Cases of cretinism have sometimes been included under this term.

Late rickets.—Rare instances have been reported of bony deformities in all respects like those of rickets, developing in children from six to twelve years old. A number of such have been observed in England. I have not seen this disease, nor has a case been seen during the past twenty years at the Hospital for Ruptured and Crippled, New York, where more deformities come under observation than anywhere else in this country.

Acute rickets.—Although from time to time cases have been reported under this heading, from a study of the histories it is clear that the great majority, if not all of them, were cases of infantile scurvy. It is doubtful whether, strictly speaking, there is such a thing as acute rickets.

Diagnosis.—The diagnosis of rickets is not usually difficult, and after carefully examining a case one can not often be in doubt. It is the mild cases and the early stages of the disease that are most liable to be overlooked. The most important early symptoms for diagnosis are sweating of the head, cranio-tabes, great restlessness at night, delayed dentition, and enlarged fontanel. All these, taken separately, may mean something else, but collectively they can mean nothing but rickets. In the later stages some of the characteristic deformities are usually present; the most constant are beading of the ribs, enlargement of the epiphyses of the wrists and ankles, and bow-legs.

Special symptoms, when unusually prominent, may give rise to difficulty in diagnosis. The enlargement of the head may be mistaken for hydrocephalus. The delayed dentition and large fontanel of the cretin may be passed over as rachitic. Muscular weakness may be so great, especially when affecting the legs, as to make it easy to confuse a rachitic pseudo-paralysis for actual paralysis due to a cerebral or spinal lesion. When walking is much delayed, rickets may be passed over as simple backwardness. In nearly all of the last-mentioned group of cases the diagnosis may be cleared up by a careful search for the bony changes, and by the fact that in rickets there is only a general weakness of all the muscles, and not actual paralysis of any limb or group of muscles. The greatest difficulty is usually found where the muscular symptoms are marked and the bony changes slight, as is not infrequently the case. Here the question is, whether rickets is sufficient to explain all the symptoms, or whether in addition some other condition is present. The electrical reactions will decide the question of poliomyelitis, while the presence of cerebral symptoms, exaggerated knee-jerks, and rigidity of the legs, will usually mark a cerebral birth-palsy. The bony enlargements of syphilis are not likely to be confounded with rickets, if it is remembered that the early lesions of syphilis are more like boggy infiltrations over the bones than actual swelling of the bone itself, and that when the bone is affected it is not at the extremity, but at the junction of the epiphysis and the shaft; the bone changes of late syphilis affect the shaft rather than the extremities of the long bones; where the bone is enlarged near the joint it is usually upon one side only. In syphilis there may be necrosis, while in rickets breaking down of bone is never seen. From scurvy, rickets is differentiated by the absence of marked hyperæsthesia, ecchymoses, and other hæmorrhages, the changes in the gums, and most of all by the fact that anti-scorbutic diet produces no immediate change in the symptoms. The diagnosis of rachitic curvature of the spine from vertebral caries will be considered in connection with the latter disease.

Prognosis.—Rickets *per se* is never a fatal disease. It is, however, a large factor in the mortality of the first two years, as the cachexia which it produces predisposes strongly to every form of acute disease. It is an important etiological factor in certain serious nervous conditions, especially convulsions. According to Gowers, ten per cent of the cases of epilepsy are in children who have suffered from rickets. Rickets adds very greatly to the danger of all acute diseases of infancy, particularly those of the respiratory tract. This depends partly upon the feeble muscular power and partly upon the thoracic deformities. The encroachment upon the capacity of the lungs by a marked thoracic deformity, may in itself be enough to keep a child in a delicate condition and retard its growth. At the same time such a condition is a constant invitation to acute attacks of bronchitis or pneumonia. The effect of rickets upon the future health of the child, depends chiefly upon the presence and extent of the thoracic deformity. When this is absent, as a rule no serious after-effects are visible, and although children may remain somewhat dwarfed on account of their short legs, in other respects they may be as well as if they had never been the subjects of rickets.

Prophylaxis.—As rickets is primarily due to improper food or feeding, and secondarily to bad surroundings, it may be prevented by the observance of proper rules of feeding as laid down elsewhere, and by removing children from their faulty surroundings. Especial care should be given to the later children of a family where the earlier ones have shown even the mildest symptoms of rickets, as the predisposition is sure to increase with each child.

Treatment.—In considering the treatment of rickets, the natural course of the disease is to be kept in mind, viz., that active symptoms frequently continue only until the tenth or twelfth, rarely longer than the eighteenth month, and that after this time the patient suffers more from the results of the disease than from the disease itself. The most important period for treatment, therefore, and the one in which it is most effective, is from the sixth to the fifteenth month. The earlier the treatment is begun the better will be its results. Constitutional treatment after the fifteenth or eighteenth month, has very little effect upon the disease, for by this time most of the harm has been done. The course of the disease when untreated is toward spontaneous recovery, from the changes in diet and life which are usually made when children have reached the latter half of the second year. Most of the cases seen in private practice are of a mild type and recover without special treatment, often no diagnosis being made until later in life, when the bony deformities or stunted growth indicate the previous existence of rickets. The first step in treatment is to remove the cause, and is therefore to be directed to the diet and hygiene of the patient. The results will depend upon how completely these causes can be removed.

Diet.—Carbohydrates, including sugars, proprietary infant-foods, and all farinaceous substances, should be reduced to the minimum, and in some cases prohibited. So far as possible the diet should consist of nitrogenous food and fats, especially milk, cream, eggs, red meat and fresh fruit. These articles are to be given according to the rules laid down in the chapters on Infant Feeding. In addition, cod-liver oil—which in these cases may be considered quite as much a food as a medicine—should be administered as soon as the stomach will tolerate it.

Hygiene.—This is the most difficult part of the treatment. In large cities it is almost impossible to secure for rachitic patients the surroundings they require. Whenever possible, such children should be sent to the country; but where this is out of the question, much may be accomplished by frequent excursions upon the water or into the country, by keeping children as much as possible in the parks and open squares of the city, and securing plenty of fresh air in sleeping rooms. Mothers are often very much afraid of fresh air, on account of the tendency of these children to take cold. If cold sponge-baths are given every morning, much can be done to lessen this susceptibility. Sunshine, though difficult to obtain in large cities, is a most efficient therapeutic agent. The establishment of suburban hospitals and homes for these cases would do more than anything else to lessen the mortality from rickets.

In a disease which tends so uniformly to recovery when causal conditions are removed, it is difficult to estimate the real value of medicinal treatment. No one thinks of relying upon drugs alone in the treatment of rickets, and where they are used in conjunction with other means it is illogical to attribute all the improvement to the drugs employed. Those most used are cod-liver oil, phosphorus, and various preparations of lime. Regarding the value of cod-liver oil, there can be no question. While it can not be ranked as a specific in rickets, it should be given in every case unless contra-indicated by the condition of the stomach, except possibly during very hot summer weather. Phosphorus has been popularized in the treatment of rickets by Kassowitz, who regards it as a specific for the disease. I have been unable to satisfy myself, after five years' experience with its use, that in the great majority of the cases it had any decided influence upon the course of the disease. The best results from phosphorus are obtained in the early cases, where there are cranio-tabes and marked nervous symptoms. But even here I have not seen the striking benefit reported by others. In the later stages of rickets, it has been difficult to see any special result from its use. Phosphorus may be administered either in the form of the officinal oil of phosphorus diluted with olive oil, or as Thompson's solution. The dose is gr. $\frac{1}{100}$ three times a day, given after meals; it should be continued for several months. In such doses I have never seen it cause unpleasant symptoms.

The absence of lime in rachitic bones has led to the use of various preparations of lime as remedies. Those most employed are the phosphate, the lactophosphate, and the hypophosphite. While these may be beneficial as tonics, they are not in any sense to be classed as specifics. It is probable that when lime is given in excess of the amount furnished by ordinary breast-milk or cow's milk, this excess passes through the bowels unabsorbed. Arsenic and iron are valuable in the treatment of rickets, the special indication for their use being the presence of marked anæmia. Profuse sweating may be relieved by small doses of atropine—i. e., gr. $\frac{1}{800}$, three or four times a day, to a child of six months.

Treatment of the rachitic deformities.—The deformities of the chest are less amenable to treatment than most of the others. After the third year something can be done by gymnastics to develop the chest muscles and to increase the pulmonary expansion. The employment of the pneumatic cabinet, in which it is sought to overcome these deformities by the use of rarefied air, has never been given the trial which it deserves. From the very meagre reports published, this appears to be of considerable value.

The deformity of the spine (kyphosis) may usually be overcome by postural treatment. The patient should lie upon a hard bed; no pillow should be allowed under the head, but in severe cases one should be placed beneath the back, so that the head and buttocks are slightly lower than the lumbar spine. While sitting, the shoulders should be kept back and the trunk supported. For a few minutes each day the child should be placed upon the face, and the deformity overcome by raising the buttocks while pressure is made upon the spine. In severe cases, an apparatus for giving spinal support, either by a steel brace or a plaster-of-Paris jacket, may be worn a few hours each day when the child is sitting up. Other means should be employed, especially friction and massage, to develop the spinal muscles.

In very many cases slight deformities of the extremities are outgrown when the general treatment can be properly carried out. Where these exist, the physician should take the curve of the limbs by seating the child upon a flat surface and tracing their outline with a pencil held perpendicularly (see Fig. 41). A fresh tracing should be taken once a month. If the deformity is not very great and no increase takes place, it is safe to continue with general treatment only. If the deformity is marked or if it increases in spite of the constitutional treatment, braces should be applied. Something may be done toward straightening the bones by intelligent manipulation. Walking should be discouraged until the bones are quite firm. Friction of the extremities, and even the use of electricity, will do very much to increase muscular development. The habit of sitting

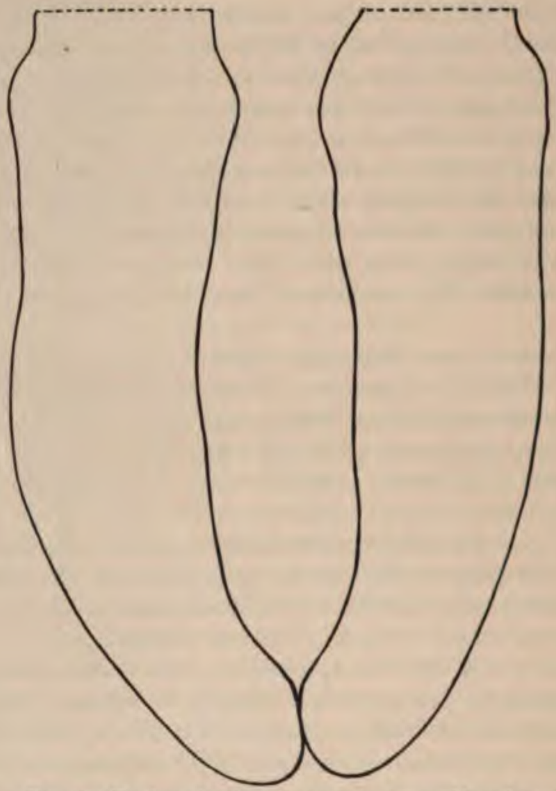

FIG. 41.—Tracing, showing the curve in a case of bow-legs.

cross-legged—a very common one of rachitic children—should be prevented, and in fact any other habitual posture, on account of the danger of increasing certain deformities. But little is to be expected from the use of apparatus for the correction of rachitic deformities after the child is two and a half years old; since at this time, and often even at two years, the bones are so firm that no amount of pressure from a steel brace will have any effect.

Without going fully into the question of the surgical treatment of rachitic deformities, for which the reader is referred to text-books on general and orthopædic surgery, I will only state that osteotomy seems to me to offer decided advantages over the other means of treating severe deformities. A vast amount of time and patience is wasted in the vain attempt to overcome very marked deformities by apparatus. The best results in osteotomy are obtained when the operation is delayed until the fourth or fifth year, by which time the bones are sufficiently firm and solid. Operations in the second year are generally unsatisfactory, and those in the third year often so, because of the bending of the bones which takes place subsequently. The deformities which require operation are bow-leg and knock-knee, less frequently the curvatures of the femur or of the bones of the forearm.

SECTION III.

DISEASES OF THE DIGESTIVE SYSTEM.

CHAPTER I.

DISEASES OF THE LIPS, TONGUE, AND MOUTH.

MALFORMATIONS.

Harelip.—This is one of the most frequent congenital deformities. It is caused by an incomplete fusion of the central process with one or both of the lateral processes from which the upper half of the face is developed. This deformity may be single or double; the fissure is never in the median line, but usually just beneath the centre of the nostril. There may be simply a slight indentation in the lip, or the fissure may extend to the nostril. Both single and double harelip—more frequently the latter—may be complicated by fissure of the palate. Double harelip is usually accompanied by a fissure between the intermaxillary and the superior maxillary bone of each side.

Cleft Palate.—This is second in frequency to harelip. It may involve the soft palate only, or the fissure may extend into the hard palate, producing a wide gap in the roof of the mouth. The most frequent form is that in which only the soft palate is affected.

For the surgical treatment of both these deformities the reader is referred to text-books upon surgery. As to the time of operation, in cases of harelip it is wisest to defer interference until the child is well started in its growth—that is, the second or third month—and in cleft palate until the third or fourth year. The medical treatment of these cases consists in the care of the mouth and in the nutrition of the patient. The mouth in all cases must be kept scrupulously clean, but the greatest care is necessary not to injure the epithelium. A camel's-hair brush and plain lukewarm water, or a weak alkaline solution, are to be recommended. Both these deformities are exceedingly likely to be complicated by thrush. This is a serious menace to the success of any operation, and even to the life of the patient. The nutrition is always a matter of much difficulty, and a very large number of these cases die of inanition or marasmus. In cases of harelip, if the fissure is so great as to interfere with nursing, the child may be fed with a spoon or a medicine dropper until the operation can be done. In cleft palate there may be attached to the rubber nipple of the nursing bottle a flap of thin sheet rubber in such a way that it closes the fissure in the mouth when once the nipple is in place. This flap should be shaped like a leaf, one extremity being sewed to the neck of the rubber nipple and the other end left free. In many cases, both before and immediately after operation, gavage (page 62) may be resorted to with the greatest benefit and with very little inconvenience.

Congenital Hypertrophy of the Tongue.—This is usually due to disease of the lymphatics, and is to be regarded as a lymphangioma. In a few cases hypertrophy of the muscular fibres has been present. The tongue may reach an enormous size, so that it is impossible for it to be contained within the cavity of the mouth, and it may thus interfere with nursing, deglutition, and even with respiration. The treatment is surgical. Cases like the above are to be distinguished from those of enlargement of the tongue seen in sporadic cretinism. In this disease the tongue is considerably enlarged and may protrude slightly from the mouth, but it is rarely, if ever, large enough to cause other symptoms. It diminishes notably under treatment with the thyroid extract.

Bifid Tongue.—These cases are extremely rare. Brothers has reported to the New York Pathological Society a case of cleft tongue in a child of one month. There was, in addition, a fissure of the soft palate.

Tongue-Tie.—This deformity is due to such a shortening of the frenum that it is impossible to protrude the tongue to a normal extent. It differs considerably in degree in different cases. In some, the tongue can not be advanced beyond the gums. Tongue-tie may interfere with articulation, and even with sucking. The treatment consists in liberating the tongue by dividing the frenum with scissors and completing the operation with the finger nail. This should be done in every case unless the child is a bleeder. In many cases the mother may think the tongue tied when the frenum is of normal length.

Bifid Uvula.—This is not very uncommon. It usually occurs in connection with cleft palate, but is occasionally seen when there is no other deformity present. It may be complete or partial, and it does not of itself require treatment.

DISEASES OF THE LIPS.

Herpes.—Herpes labialis is an exceedingly common affection in children, occurring in acute febrile diseases, particularly pneumonia, and sometimes alone. It is the familiar "fever sore" or "cold sore" of domestic medicine. The appearance is similar to herpes in other parts of the body. There is first a group of vesicles, then rupture and the formation of crusts. It is often quite difficult to cure on account of the disposition of children to pick the lip with the fingers. Although it heals without treatment, recovery is facilitated by the use of some antiseptic lotion, such as dilute boric acid, followed by a dusting powder of zinc oxide and boric acid. This treatment is generally more successful than the use of ointments. Young children should wear mittens at night, to prevent picking at the crusts.

Eczema of the Lip.—This is an exceedingly common condition, and a very troublesome one. The vermilion border is dry and rough, and prone to deep cracks or fissures. These are usually seen at the angles of the mouth or in the median line. When severe they are exceedingly painful, bleed freely, and are the cause of very great discomfort, especially in the cold season. The lips should be covered at night by simple ointment, and this should be used as much as possible during the day. Where deep fissures form, they should be touched with burnt alum, or with the solid stick of nitrate of silver. Syphilitic fissures are considered with the symptoms of that disease.

Perléche (French, *perlécher = to lick*).—This name was first given by Lemaistre, in 1886, to a form of ulceration occurring usually at the angle of the mouth. It begins in most cases as a small fissure, which, by constant licking and irritation, to which there is usually added infection, may produce an intractable ulcer of considerable size. It often resembles the mucous patch of hereditary syphilis. The ulcer is of a grayish colour, is quite painful, and is associated with considerable swelling of the lip. It lasts from two to four weeks. The treatment is the same as in simple fissure—viz., the use of burnt alum or nitrate of silver, and covering the part with bismuth or oxide of zinc.

DISEASES OF THE TONGUE.

Epithelial Desquamation.—This is a disease of the lingual epithelium, which is characterized by the appearance upon the dorsum or margin of the tongue, of circular, elliptical, or crescentic red patches, with gray margins which are slightly elevated. It is sometimes improperly called psoriasis of the tongue. It is quite a common condition.

The beginning of the disease is not often seen. It is stated first to appear as a white or gray patch, like thickening of the epithelium. These patches enlarge quite rapidly, and are followed by detachment of the epithelium and the formation of bright red areas, which are the parts denuded of epithelium. As usually seen, there exists upon the tongue from two to half a dozen of these red patches surrounded by a gray border, which is about one twelfth of an inch wide, and slightly elevated. The outline of the patch is nearly always crescentic (see Fig. 42). From day to day the configuration of the patches changes; the gray lines advance across the tongue from side to side, or from base to tip, disappearing as they reach the border or the extremity. They are followed by the red patches, and as the old ones fade away new ones form and run the same course. The white border seems to be made up entirely of epithelium.

The red patches are of a bright colour nearest the border, gradually shading off into the normal colour of the tongue. Only the epithelium is involved, the deeper structures being unaffected. The duration of the disease is indefinite; it usually lasts for months, and often for years. Guinon reports several cases in which a cure took place during an intercurrent attack of measles or scarlet fever.

The cause is unknown. The condition occurs rather more frequently in females than in males, and Gubler has reported an instance of several members of the same family being affected. Most of the cases are seen in infancy and early childhood. The condition has been thought to depend upon nearly every disease of this period. Parrot believed that it was always syphilitic, but this view has been effectually disproved by subsequent observation. The disease is not accompanied by pain, salivation, or by other symptoms of stomatitis, and it is of little practical importance. Its symptoms are so characteristic that it can hardly be mistaken for any other condition. Treatment is unnecessary.

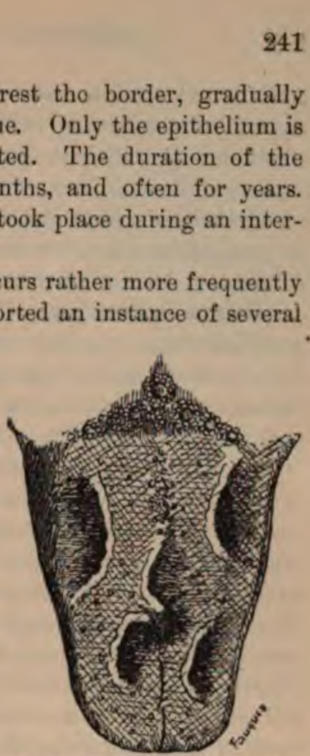

FIG. 42.—Epithelial desquamation of the tongue. (Guinon.)

Two other forms of epithelial desquamation have been observed, both much more rare than that described. In one of these the red denuded portion occupies the margin of the tongue, while the centre is gray or white; the irregular wavy outline which separates the two suggests strongly an outline map, and the condition is sometimes called the "geographical tongue." In another variety nearly the whole organ may be uniformly red, from loss of the epithelium, there being no borders or patches. Both these varieties are of much shorter duration than the more common form, usually lasting only a few weeks.*

Glossitis.—Inflammation of the tongue is not very common in children. It is usually of traumatic origin. The injury may be due to biting the tongue in a fall or in an epileptic seizure. Glossitis is sometimes excited by the irritation of a sharp tooth, causing a wound which may be the avenue of infection; or it may result from taking into the mouth irritant or caustic poisons. In a small number of cases no cause can be found. The symptoms are marked swelling of the tongue, so that it may protrude from the mouth; and it may even be so great as to cause severe dyspnœa. There are also profuse salivation, difficulty in swallowing and in articulation, and often considerable local pain. There may be a rise of temperature to 102° or 103° F. The treatment consists in the use of fluid food, which in severe cases may be introduced through the nose by means of a catheter. Ice may be used externally, or, better still, pieces of ice should be kept in the mouth continually. If there is obstruction to respiration, and in all severe cases, scarification should be done on the dorsum along the side of the raphé.

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* For a fuller description and literature of the subject, see Guinon, Revue Mensuelle des Maladies de l'Enfance, 1887, p. 585; and Gautier, Revue Médicale de la Suisse, Romande, October and November, 1881.

Tongue-swallowing.—This term is used to describe a rare condition seen in infants, in which the tongue is turned backward into the pharynx, so as to obstruct respiration. It may be drawn quite into the œsophagus. Several marked cases have been collected by Hennig.* One of these will suffice as an illustration. A well-nourished infant of three months, in the course of a severe paroxysm of pertussis, was seized with convulsions, followed by asphyxia, and died in a few minutes. After death the tongue was found to be doubled upon itself, its tip being tightly wedged into the œsophagus. While most frequently occurring with pertussis, tongue-swallowing has been seen in other diseases. I have never met with cases of such severity, although in several instances I have seen marked dyspnœa produced in young infants by the folding backward of the tongue. Tongue-swallowing should not be forgotten as one of the explanations of sudden asphyxia in a young infant. The conditions necessary to its production are a somewhat relaxed organ or a long frenum. In none of the fatal cases reported, however, had the frenum been divided. In some weak infants, falling back of the tongue, so that its base partly covers the epiglottis, produces asphyxia, precisely as it occurs in adult life under full anæsthesia. The recognition of the condition is a very easy one, and its treatment is to relieve the obstruction by drawing the tongue forward by the finger or forceps.

Ulcer of the Frenum.—The friction against the sharp edges of the lower central incisors frequently causes an ulcer of the frenum in infants. I have never seen it in older children. It usually occurs in pertussis, but is seen in other cases. In some it appears to be produced by friction of the teeth during nursing from the breast or bottle. It is more often seen in children who are delicate or cachectic than in those who are healthy and well nourished. The ulcer may be confined to the frenum, or it may extend quite deeply into the tongue. It is usually about one fourth of an inch in diameter, and of a yellowish-gray colour. When not readily cured by touching with alum or nitrate of silver, the child may be fed by gavage for several days, or the teeth may be covered by a bit of absorbent cotton.

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* Jahrbuch für Kinderheilkunde, xi, 299.

ALVEOLAR ABSCESS.

This is common in children, especially among the class of hospital and dispensary patients, in whom little or no attention is given to the care of the teeth. It causes severe pain and acute swelling, which may be limited to the gum, or it may involve to a considerable extent the periosteum of the jaw, and even cause swelling of the whole side of the face. If there is retention of pus, there may be quite severe constitutional symptoms, such as a chill and high temperature; but in most of the cases these are wanting. The abscess usually opens spontaneously into the mouth, but it may open externally if the molar teeth are the ones affected. It may even lead to necrosis of the jaw. If its site is the upper jaw, the pus may find its way into the nasal cavity or into the maxillary sinus.

The treatment is, in the first place, prophylactic. This requires attention to the teeth to prevent decay, and the removal of old carious fangs, which are a constant menace to the health of the child in more ways than one. The free use of the toothbrush and some antiseptic mouth-wash will, in the great majority of cases, prevent the occurrence of this disease. It is important that the abscess be opened early and free drainage secured. If there is a carious tooth it should be drawn.

DIFFICULT DENTITION.

The place of dentition as an etiological factor in the diseases of infancy is one which has given rise to much discussion. From a very early period the view has descended, that a large number of the diseases occurring between the ages of six months and two years were due to difficult dentition. The list of such diseases is a long one, but year by year it has been shortened as one after another has been shown to depend upon other causes, dentition being only a coincidence.

At the present time many good observers deny that dentition is ever a cause of symptoms in children; some even going so far as to say that the growth of the teeth causes no more symptoms than the growth of the hair. Without doubt the usual mistake made in practice is in overlooking serious disease of the brain, kidneys, lungs, stomach, and intestines, because of the firm belief that the child was "only teething." The physician who starts out with the idea that dentition may produce all symptoms in infancy, usually gets no further than this in his etiological investigations. Although I strongly believe that the importance of dentition as an etiological factor in disease has been in the past greatly exaggerated, and although I have formerly held the opinion that simple dentition did not and could not produce symptoms, within the past few years I have been compelled by clinical observations to change my opinion upon this subject; and I am now willing to admit that dentition may produce many reflex symptoms, some even of quite an alarming character.

Speaking from impressions, not from statistics, I should say that in my experience about one half of the healthy children cut their teeth without any visible symptoms, local or general; in the remainder some disturbance is usually seen, and though in most cases it is slight and of short duration, it may last for several days or even a week. The symptoms most commonly seen are disturbed sleep, or wakefulness at night and fretfulness by day, so that children often sleep only one half the usual time. There is loss of appetite, and much less food than usual is taken. There is often, but not always, an increase in the salivary secretion, a slight amount of catarrhal stomatitis, and a constant disposition on the part of the child to stuff the fingers into the mouth. The bowels are often constipated or there may be slight diarrhœa. The thermometer may show a slight elevation of temperature to 100° to 101·5° F. The weight may remain stationary for a week or two, and there may even be a loss of a few ounces. The duration of these symptoms in most cases is but a few days, and they require no special treatment. If the food is forced beyond the child's inclination, attacks of indigestion with vomiting and diarrhœa are easily excited.

Symptoms more severe than the above are rare in healthy children, but are not infrequent in those who are delicate or rachitic. In such susceptible children, even so slight a thing as dentition may be the cause, or at least the exciting cause, of quite serious symptoms. Often there is some other factor in the case, such as bad feeding or feeble digestion. In delicate or rachitic children there may be seen the symptoms already mentioned as occurring in healthy infants, but in greater severity; and in addition there may be severe attacks of acute indigestion. Occasionally there is quite high fever, from 102° to 104° F., lasting usually only two or three days, but in rare cases for a week, and accompanied by no other symptoms except almost complete anorexia. Convulsions which could fairly be attributed to dentition I have never seen, yet I do not doubt that they may occur in rachitic children. There are certain cases of eczema in which the symptoms undergo a distinct exacerbation with the eruption of each group of teeth. As regards almost all the other diseases which are commonly attributed to dentition, I believe that it is a delusion to trace them to this cause.

The physician should watch a child carefully, and examine it frequently, to be sure that he is not overlooking some serious local or constitutional disease before he allows himself to make the diagnosis of difficult dentition. Probably in ninety-five per cent of the cases in which the above symptoms are present, they are due to some cause other than dentition. When, however, symptoms such as any of those mentioned disappear immediately when the teeth come through, and when we see them repeated four or five times in the same child with the eruption of each group of teeth, and accompanied by red and swollen gums, I think we can not escape the conclusion that dentition has been a factor in their production, though perhaps not the only one.

In the treatment of this condition drugs occupy but a small place. It should be remembered that infants are at this time in a peculiarly susceptible condition, as regards the digestive tract, and attacks of indigestion, and even severe diarrhœa, are readily excited from slight causes, especially from overfeeding. Special care should be exercised in this respect. The strength of the food should be reduced, as well as the amount given. The poor appetite indicates a feeble digestion, which should not be overtaxed. As attacks of bronchitis and acute nasal catarrh are readily induced, even slight exposure should be guarded against. The nervous symptoms, when severe, may be relieved by the use of moderate doses of bromide and phenacetine, better than by opiates. All soothing syrups should be discountenanced. All the various devices for making dentition easy are a delusion. In a small number of cases lancing the gums is of decided value. I have myself seen marked and undoubted relief given by it. This is likely to be the case where the gums are tense, swollen, and very red, with the teeth just beneath the mucous membrane. That lancing the gums is often required I do not believe; that it is done by many physicians too frequently is no doubt true; but it should still have a place in our therapeutic measures. Care should always be taken that infection is not carried by the lancet.

CATARRHAL STOMATITIS.

This is characterized by redness and swelling of the mucous membrane, and by increased secretion of the salivary and the muciparous glands of the mouth. It usually involves a large part of the mucous membrane.

Etiology.—Catarrhal stomatitis may result from traumatism. This injury may be mechanical, or due to heat or any irritant accidentally taken into the mouth. It frequently occurs at the time of the eruption of a tooth. It complicates measles, scarlet fever, diphtheria, influenza, and many other infectious diseases. In these cases, and in many others, the disease is probably due to direct infection.

Lesions.—The lesions are essentially the same as in catarrhal inflammations of other mucous membranes. There are congestion with desquamation of epithelial cells, and sometimes the formation of superficial ulcers. The process may be a very superficial one, or it may extend to the submucous tissue.

Symptoms.—The whole mucous membrane is intensely injected, all the capillaries are dilated, and small hæmorrhages easily excited. The mucous membrane is swollen, this being most apparent over the gums or about the teeth. There may be some swelling of the lips. The mouth seems hot, and the local temperature is certainly increased. There is considerable pain, as shown by fretfulness, but particularly by the disinclination to take food: infants, though evidently hungry, either refusing the breast or bottle altogether, or dropping it after a few moments. The increase in secretion is sometimes marked, so that the saliva pours from the mouth, irritating the lips and face and drenching the clothing. In other cases the saliva is swallowed. On close inspection there may be seen swelling of the muciparous follicles, and even the formation of tiny cysts from the accumulation of secretion within them (Forchheimer). The tongue is usually coated, the edges reddened, and the papillæ prominent. In febrile diseases, such as typhoid, etc., we may get an accumulation of dead epithelium with the formation of cracks and fissures of the tongue, and the lips may present a similar condition. The neighbouring lymphatic glands are slightly enlarged and tender. The constitutional symptoms accompanying simple stomatitis are not severe, but some disturbance is almost always present. There may be derangement of digestion with vomiting, and even a mild attack of diarrhœa. In the majority of cases the disease runs a short course, recovery taking place in a few days when the primary cause is removed. In very delicate children it may be prolonged, and from the interference with nutrition may even lead to serious consequences.

Treatment.—The mouth and teeth should be kept clean. Food is more acceptable if given cold. In very severe cases, where food is refused, gavage may be resorted to three or four times daily. In all cases children may be given ice to suck. This is refreshing, both on account of the cold and from the relief to the thirst. The mouth should be kept clean with a solution of boric acid, ten grains to the ounce, or an alkaline solution, such as Dobell's, diluted with an equal amount of cold boiled water; or simply water may be used. In the severe forms, where there is much swelling and slight catarrhal ulceration, astringents are required. In my experience alum is the best; this may be applied in the form of the powdered burnt alum mixed with an equal amount of bismuth, or in solution, ten grains to the ounce, with a swab or brush. Where ulcers are slow in healing and very painful, the powdered burnt alum may be applied directly.

HERPETIC STOMATITIS.

Synonyms: Aphthous, vesicular, follicular stomatitis.

In this form of stomatitis we have the appearance first of small yellowish-white isolated spots, and subsequently the formation of superficial ulcers. These ulcers are first discrete, but may coalesce and form others of considerable size. It is a self-limited disease, usually running its course in from five days to two weeks.

Etiology.—Very little is as yet positively known regarding the cause of herpetic stomatitis. Forchheimer reports bacteriological investigations as yielding negative results. I adopt the term *herpetic* to designate this disease, because I believe, with Forchheimer* and others, that it is of nervous origin. There is yet lacking sufficient evidence to establish the fact that it is contagious. It occurs most frequently about the end of the first year, but may be seen at any period of childhood, least frequently in very young infants. It is often associated with disturbances of the stomach, and an attack may be coincident with the eruption of the teeth.

Lesions.—The exact nature of the lesion is still a matter of dispute. The view generally accepted is, that there is first the formation of a vesicle, followed by death of the epithelial cells covering it, and the production of an epithelial ulcer; the process being thus regarded as analogous to herpes of the skin. These ulcers may extend superficially, but never deeply; they commonly heal quickly with the formation of new epithelial cells, leaving no cicatrices behind them. Herpetic stomatitis is always associated with more or less catarrhal inflammation.

Symptoms.—The symptoms of herpetic stomatitis may precede or follow those of a catarrhal inflammation. The characteristic feature is the appearance of small, shallow, circular ulcers, usually coming in successive crops. While most frequent at the border of the tongue and the inside of the lips, they may be found upon any part of the mucous membrane of the mouth or the pharynx. There may be only half a dozen present, or the mouth may be filled with them. They are first of a yellowish colour, and on an average about one eighth of an inch in diameter. By the coalescence of several smaller ones there may form patches of considerable size, sometimes nearly covering the lips. The older ulcers are apt to have a dirty grayish colour, and in places may look not unlike a diphtheritic membrane. The smaller ones are surrounded by a red areola, and when healing the margin is of a bright red colour. Their appearance is often more like that of an exudation upon the mucous membrane than an excavation into it. The other symptoms are much the same as in catarrhal stomatitis, but usually of greater severity. The pain is particularly intense, it being often difficult to induce children to take anything in the form of food. The tongue is frequently coated, but there is never the foul breath of ulcerative stomatitis. The duration of the disease is from one to two weeks, and, if the child is in good condition, complete recovery takes place even without any special treatment. In badly nourished children the disease may last for two or three weeks; relapses may occur, and the condition may interfere very seriously with the child's nutrition.

Treatment.—This is the same as in catarrhal stomatitis, with the addition that to each one of the ulcers finely powdered burnt alum should be applied with a camel's-hair brush. If this is not effective, the solid stick of nitrate of silver may be used. The ulcers will usually yield rapidly to this treatment. In my experience, drugs given with the purpose of affecting the lesion in the mouth have been without benefit.

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* Archives of Pædiatrics, ix, 330.

ULCERATIVE STOMATITIS.

This form of stomatitis is only seen when teeth are present. It is characterized by an ulcerative process, beginning at the junction of the teeth and the gum, and extending along the teeth, involving secondarily other parts of the mouth, but never spreading beyond the buccal cavity. It occurs from several quite distinct causes, and, while not tending to spontaneous recovery, it is in most cases readily curable by the internal administration of chlorate of potash, which may be looked upon as a specific remedy.

Etiology.—Ulcerative stomatitis may be due to certain of the metallic poisons, particularly mercury, lead, and phosphorus; but from all these it is now rare, and not so often seen in children as in adults. It sometimes occurs as a sequel of acute infectious diseases. Most of the cases are seen in hospital and dispensary patients, in children whose general health is below par and who have suffered from the lack of proper food. In private practice among the better classes, it is a rare disease. A local cause of much importance is the common neglect among the poor of cleanliness of the mouth and teeth, and the presence of carious teeth. This is the form of stomatitis which occurs in scurvy; and it seems not unlikely that an allied disturbance of nutrition, causing a spongy, swollen condition of the gums, exists prior to many cases of ulcerative stomatitis. Given this state of things, it is easy to see how germs present in the mouth, finding a ready entrance, may set up an active inflammatory process; the diminished vitality from general condition taking the part of a primary cause, and infection that of a secondary one. Bacteriological investigations of these cases thus far made have revealed only the ordinary pyogenic bacteria.

Lesions.—The disease may begin at any part of the mouth, but most frequently upon the outer surface of the gum along the lower incisor teeth. From this point it extends behind the teeth, and from the incisors to the canines and molars, usually of one side only; but it may involve the whole gum and both jaws. From the gums the process may spread to the lips, affecting the fold of mucous membrane between the gum and the lip, and also to the inner surface of the cheek, especially opposite the molar teeth, where large ulcers often form. In neglected cases the disease may extend into the alveolar sockets, the teeth loosening and falling out. The periosteum of the alveolar process may be involved, and even superficial necrosis of the jaw may occur, as happened in three cases that came under my observation.

Symptoms.—The first things noticed are the very offensive breath and the profuse salivation. It is usually for one of these that the patient is brought for treatment. On inspection of the mouth, there is seen in the mild cases, swollen, spongy gums of a deep red or purplish colour, which bleed at the slightest touch. There is a line of ulceration, usually along the incisor teeth, most marked in the front, which may extend to any or to all of the teeth; sometimes it affects only the gum along the molar teeth, the incisors escaping. At the junction of the teeth and gum is seen a dirty, yellowish deposit, on the removal of which free bleeding takes place. The diseased parts are very painful, and the child cries, and resists any attempt at examination. In the more severe cases and in those of longer duration the teeth are loosened, sometimes being so loose that they can be picked from the gum. There may be necrosis of the jaw, and even a loose sequestrum may be found. The ulceration along the gums in these cases is deeper, and there may be ulcers in the cheek opposite the molar teeth, or inside the lip. The swelling may be so great that the teeth are almost covered; this is seen particularly in the scorbutic form. The saliva pours from the mouth, adding greatly to the discomfort of the patient. Beneath the jaw are felt the large, swollen lymphatic glands, which are painful and tender to the touch, but show no tendency to suppurate. The tongue is somewhat swollen, and shows at the edges the imprint of the teeth; it is thickly coated with a dirty yellow fur. The general condition of these patients is usually poor, and there may be quite a marked cachexia. Other forms of stomatitis, particularly the herpetic, may be associated, and it should not be forgotten that the gangrenous form may follow.

When not recognised or not properly treated, ulcerative stomatitis may last for months, and seriously affect the patient's general health. When properly treated it tends in all recent cases to rapid recovery, usually in a few days. No deformity of the mouth is left, the only untoward results being shrinking of the gum, sometimes loss of some of the incisor teeth, and more rarely a superficial necrosis of the alveolar process. All these are quite uncommon. Ulcerative stomatitis can hardly be confounded with any other form, and not only should a diagnosis of the lesion be made, but the condition upon which it depends should, if possible, be discovered; scorbutus, particularly, should not be overlooked.

Treatment.—The first thing to be done is to remove the cause. When dependent upon metallic poisoning the source should be discovered. Scorbutic cases should have the usual anti-scorbutic diet. Cleanliness of the mouth is of great importance, and this may best be accomplished by the use of peroxide of hydrogen diluted with from two to ten parts of water. It should be followed by plain water, and repeated several times a day. In other cases an astringent solution of alum, five grains to the ounce, or a mouth-wash of chlorate of potash, three grains to the ounce, may be employed. The only objection to the last mentioned is the pain which it usually produces.

The specific remedy for ulcerative stomatitis is chlorate of potash. The best method of administration is to give two grains or one half teaspoonful of a saturated solution, largely diluted, every hour during the day for the first twenty-four hours and subsequently every two hours; when improvement occurs the dose may be still further reduced. Marked benefit is usually seen in one or two days even in cases that have lasted for several weeks. If the case does not yield readily to this treatment there is probably disease at the roots of the teeth, and when loose these should be removed, and the jaw examined to see if there is necrosis. Occasionally the ulcers show but little disposition to heal, and require to be touched with burnt alum or nitrate of silver.

The constitutional and dietetic treatment in all these cases should be the same as that employed in scurvy—i. e., plenty of fruit, fresh vegetables, and sometimes the internal administration of mineral acids, especially aromatic sulphuric acid. Iron is indicated in most of the cases.

Ulceration of the Hard Palate.—This is usually seen in the first few weeks of life, but may occur in any child suffering from marasmus. The primary cause may be the injury inflicted in cleansing the mouth. In other cases it is due to the friction of the rubber nipple, or something else which the child is allowed to suck. In still others it is apparently produced by the habit of tongue-sucking frequently observed in these young infants. The appearances are quite characteristic: there is found, rather far back upon the hard palate, usually upon both sides, a superficial ulcer, from a fourth to a half inch in diameter. There are no signs of acute inflammation. Thrush may coexist, but it has no relation to the production of the disease. Spontaneous recovery usually occurs in from one to three weeks, provided the cause can be removed. In children suffering from marasmus these ulcers are very intractable, and in many instances their cure is practically impossible. It is therefore especially important to prevent, if possible, their formation by care in cleansing the mouth, and in avoiding the other causes referred to. When ulcers have appeared they should be treated as cases of herpetic stomatitis.

THRUSH.

Synonyms: Sprue; German, Soor; French, muguet.

Thrush is a parasitic form of stomatitis characterized by the appearance upon the mucous membrane, usually of the tongue or of the cheeks, of small white flakes or larger patches. It is common in infants of the first two or three months, and in all the protracted exhausting diseases of early life.

Etiology.—The parasite which produces thrush is a form of fungus, but the exact class to which it belongs has not yet been definitely settled. It is now known that it is not the *oïdium albicans*, but that it belongs to the group of the saccharomyces, and the term *saccharomyces albicans* has been given to it. If a little of the exudate from the mouth is placed upon a slide and a drop of liquor potassæ added, the structure of the fungus is readily seen. With the low power of the microscope there can be made out fine threads (the mycelium) and small oval bodies (the spores). With a high power the threads can be seen to be made up of a number of shorter rods, at the ends of which the spore formation takes place (Fig. 43). The mycelium is produced from the spores. The spores of this fungus are of very common occurrence in the atmosphere. The conditions in the mouth which favour its growth are any pathological condition of the epithelium, particularly a slight amount of catarrhal stomatitis, a scanty salivary secretion and want of cleanliness. The fungus may grow in a medium of any reaction, but best in one which is slightly alkaline or neutral. The nature of the process which it produces is in all probability a sugar fermentation, the acid reaction of the mouth being the result of the growth rather than its cause. Infection may come from another patient by means of a rubber nipple or a cloth which has been used for the infected mouth, from the nipple of the nurse, or directly from the air. The disease is an exceedingly common one in foundling asylums, in all places where many young infants are congregated, and where cleanliness of mouths, bottles, etc., is neglected. It is especially frequent in children suffering from malnutrition, marasmus, or other wasting diseases, and in those who have hare-lip, or any deformity of the mouth.

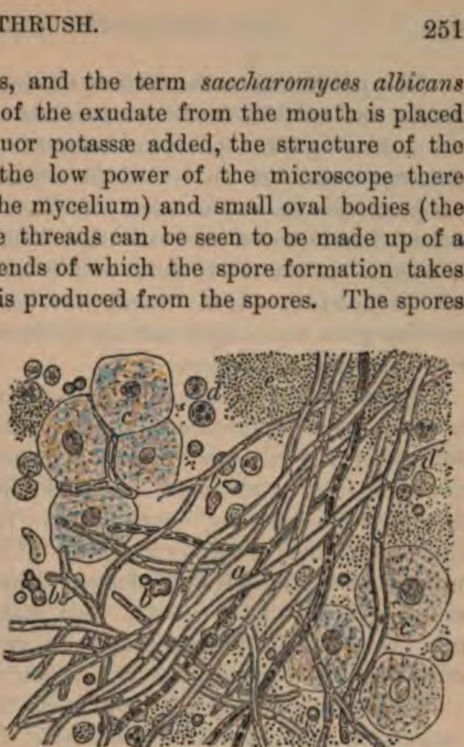


Fig. 43.—Thrush fungus (highly magnified). *a*, mycelium; *b*, spores; *c*, epithelial cells from the mouth; *d*, leucocytes; *e*, detritus. (Jaksch.)

Lesions.—According to Forchheimer, the spores lodge between the epithelial cells and gradually separate the different layers. This occurs before the formation of the white pellicle. Later the disease spreads to the surface of the mucous membrane, and also somewhat to the deeper layers. It is stated by Wagner that it may invade the blood vessels and be carried to distant parts. Although the saccharomyces albicans is commonly found upon flat epithelium, its growth is not confined to it. It usually begins at many isolated spots upon the mucous membrane, and gradually spreads until coalescence takes place; a continuous membrane may be formed. No pus is produced by the process.

The usual seat is the tongue, the inside of the cheeks, and the hard palate, but not infrequently it involves the lips, the tonsils, the pillars of the fauces, and the pharynx. Further extension than this is very rare, although cases are on record in which thrush has been found in the œsophagus, in the stomach and intestines, and even in the lower respiratory tract. I have never seen extension farther than the œsophagus, and this but once or twice. I know of but one reported case in this country (Northrup's) in which thrush has been seen in the stomach. Cases involving the œsophagus and the stomach appear from reports to be much more common in Europe.

Symptoms.—The essential symptoms of thrush are the appearance upon the mucous membrane of the mouth—usually beginning upon the tongue or the inner surface of the cheek—of small white flakes which resemble deposits of coagulated milk, but which differ from them in the fact that they can not be wiped off. If forcibly removed, they usually leave a number of bleeding points. There may be only a few scattered patches, or the mouth and pharynx may be covered. The mouth is generally dry, the tongue coated; food may be refused on account of pain, and there may be some difficulty in swallowing. The other symptoms depend upon the conditions with which the thrush is associated.

Diagnosis.—This is rarely difficult. The deposit may be mistaken for coagulated milk, but is distinguished by the features just mentioned. When existing upon the pharynx and fauces it has been confounded with diphtheria, although this mistake can hardly be made if all the features of the case are taken into consideration—the age of the patient, the involvement of the lips and tongue, the dry mouth, the absence of glandular enlargement, etc. In any case of doubt the examination of the deposit under the microscope at once reveals its true nature.

Prognosis.—Thrush is not in itself a dangerous disease, except in the very rare instances where it may obstruct the œsophagus, and this can hardly occur except in a condition of exhaustion which is necessarily fatal. In a feeble and delicate infant, thrush may be a serious complication by interfering with the taking of sufficient nourishment. With proper treatment most of the cases involving only the mouth are readily cured.

Treatment.—Thrush may be prevented in almost every case by due attention to cleanliness of the mouth, rubber nipples, bottles, cloths, etc. All rubber nipples should be kept in a solution of borax or salicylate of soda, and the child's mouth should be cleansed several times a day. On no account should a feeding-bottle be passed from one child to another.

In the treatment of the disease the essential things are cleanliness, and the use of some mild antiseptic mouth-wash. The routine treatment which I have followed for many years both in hospital and private practice, is to cleanse the mouth carefully after every feeding or nursing with a solution of borax or bicarbonate of soda, ten grains to the ounce, and to apply four times a day to the affected mucous membrane a saturated solution of boric acid. Both these applications, however, should be carefully made, so as not to injure the epithelium. The best method is by the finger wrapped in absorbent cotton, or by a swab. Applications to be especially avoided are those mixed with honey or any syrup. In several hospital cases the disease seemed to be prolonged by the irritation of the rubber nipple of the feeding-bottle. In such cases it has been our practice to feed by gavage for two or three days, as all cases improved much more rapidly when this was done.

GONORRHŒAL STOMATITIS.

There has been described by Dohrn and Rosinski a form of stomatitis in the newly born, due to a gonorrhœal infection. This is not likely to take place unless the epithelium has been removed. The infection in all cases occurred from the mother. The lesion consists in the formation of yellowish-white patches upon the tongue or hard palate—regions in which the epithelium is likely to be injured by rough attempts at cleansing the mouth. There may be other evidences of gonorrhœal infection, such as ophthalmia. The diagnosis rests upon the discovery of the gonococcus in the exudate. In all the above cases the general health was not affected, and recovery followed in the course of a week or ten days.

The treatment consists in thorough cleanliness and in the application of a saturated solution of boric acid, as in thrush.

SYPHILITIC STOMATITIS.

The buccal symptoms of hereditary syphilis are important both from a diagnostic and therapeutic standpoint. The most frequent lesions are fissures, ulcers, and mucous patches. Fissures are found upon the lips, most frequently at the angle of the mouth, and are usually multiple. They may be quite deep and cause frequent hæmorrhages. Mucous patches are superficial ulcers developing from papules which form upon the mucous or muco-cutaneous surface. In cases of acquired syphilis in children the primary sore may be seen upon the tongue, the lip, or the tonsil. All these symptoms are more fully considered in the chapter on Syphilis.

DIPHTHERITIC STOMATITIS.

In severe cases of diphtheria the membrane is found not only upon the pharynx and tonsils, but it may appear anywhere upon the buccal mucous membrane or the lips. It is questionable whether the diphtheritic process ever begins in the mucous membrane of the mouth, or whether it is ever confined to this part. In my own experience diphtheritic stomatitis has always been associated with deposits upon the tonsils and pharynx. It is seen only in the severest cases, and in those which, from other conditions which are present, are almost necessarily fatal. Bearing in mind the above points, it can hardly be mistaken for any other variety of stomatitis, although not infrequently the mistake is made of regarding as diphtheritic, cases of herpetic stomatitis in which the ulcers have coalesced. The treatment, so far as the mouth is concerned, consists in cleanliness by frequent gargling or syringing with a saturated solution of boric acid. Forcible removal of the membrane is not to be advised.

GANGRENOUS STOMATITIS.

Synonyms: Cancrum oris, noma.

This is a gangrenous process which begins usually upon the gums or upon the inside of the cheek, and extends with great rapidity, causing extensive destruction of the tissues of the mouth, often perforation of the cheek, and usually terminating fatally. It is fortunately a rare disease. Although this is usually classed among the diseases of the mouth, the same process may occur elsewhere. I have known it to affect primarily the nose and the external auditory meatus. Cases affecting the female genitals are even more common.

Etiology.—Gangrenous stomatitis is usually a secondary disease, occurring most frequently as a complication of measles, but sometimes with other exhausting diseases of infancy and childhood. It is not often seen except in institutions for children. Whether or not there is a specific form of infection has not yet been established. In a recent case occurring in the Babies' Hospital streptococci were found in pure culture. Streptococci chiefly were found in observations by Cornil and Babes, and by Ranke. The factors necessary for the production of the disease are a very low vitality of the tissues, and infection, which, with our present knowledge, is most probably by streptococci of a peculiarly virulent type.

Gangrenous stomatitis often follows some other form, usually the ulcerative, although the two can hardly be considered as the same disease, differing only in severity.

Lesions.—The process is one of rapidly spreading gangrene. In most of the cases there are thrown out inflammatory products in quite large amount, but there is little or no tendency to limitation of the disease. This usually advances steadily until death occurs. In a small number of cases a line of demarcation finally forms, and the slough separates, leaving a large area to be partly filled in by granulation and cicatrization. Other infectious processes are likely to accompany the disease, particularly broncho-pneumonia.

Symptoms.—The general symptoms are those of profound prostration and sepsis. The constitutional depression may be great at the very beginning, or the children at first may be in fair condition, but rapidly grow worse in the course of two or three days. The temperature is usually elevated to 102° or 103° F., and sometimes to 104° or 105° F. There are dulness, apathy, feeble pulse, muscular relaxation, and very often diarrhœa. Before death the temperature may be subnormal.

Of the local symptoms, often the first to attract attention is the odour of the breath; sometimes it is the dusky spot on the cheek or lip. On examination of the mouth, there usually is found upon the gum or inside of the cheek a dark, greenish-black necrotic mass, surrounded by tissues which are swollen and œdematous, so that the cheek or lips may be two or three times their normal thickness. Externally the parts are tense and brawny from the swelling, this infiltration always extending for some distance beyond the gangrenous part. As the process extends, the teeth loosen and fall out; there may be necrosis of the alveolar process of the jaw and perforation of one or both cheeks or lower lip. Extensive sloughing of the face may take place, usually upon one side, sometimes upon both, giving the patient a horrible appearance, as shown in Fig. 44. In this patient the process began in the right cheek, subsequently involving the left; perforation occurred in both cheeks, and before death a large part of the face was gangrenous. The odour from a severe case is very offensive, and, in spite of all efforts at disinfection, it may fill the ward or even the house. Pain is rarely severe, and in many cases it is absent. Extensive hæmorrhages are rare.

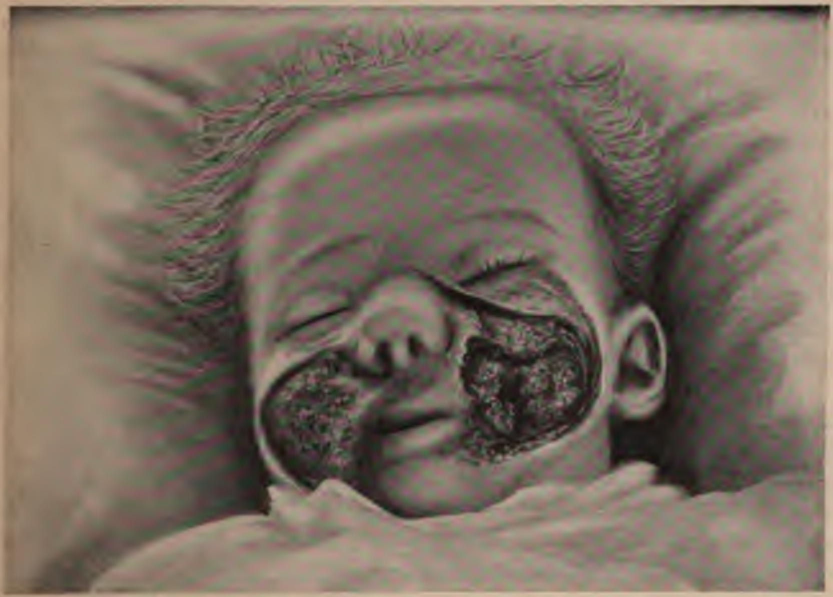


FIG. 44.—Gangrenous stomatitis, following measles. (From a photograph lent by Dr. Henry Moffat.)

The usual duration of the disease is from three to seven days; in some cases it may last two weeks. If recovery takes place, there is seen a line of demarcation; then the slough is thrown off, and granulation and cicatrization begin, but require a long time, usually leaving an unsightly deformity.

The prognosis is very bad, about three fourths of the cases proving fatal. The results depend not only upon the disease itself, but upon the condition of the patient with which it is associated.

Gangrenous stomatitis can hardly be mistaken for any other form of disease occurring in the mouth, and early recognition is of great importance, since only early treatment is likely to be successful.

Treatment.—Much can be done to prevent the disease by careful attention to all the milder forms of stomatitis, particularly to the ulcerative variety. Frequent and thorough cleansing of the mouth in all acute infectious diseases, is a part of the treatment which is too frequently neglected. This should be a matter of routine in every severe illness in a young child. Recognising the malignant nature of gangrenous stomatitis, its treatment should be radical from the very outset. Of the measures which have been proposed, that which seems to offer the best chance of arresting the process is excision with cauterization. This should be done under anæsthesia. In excising, one should go some distance into tissues apparently healthy, for the reason that the process has always advanced farther in the subcutaneous tissues than in the skin. The edges of the wound should then be thoroughly cauterized, best by the Paquelin cautery. Of the other means employed, the use of strong nitric acid is probably the best. This is to be used after excising, or curetting the necrotic tissue. The mouth should be kept as clean as possible by the use of peroxide of hydrogen or permanganate of potash. The general treatment should be supporting and stimulating. As the possibility of contagion exists, every case should be isolated.

CHAPTER II.

DISEASES OF THE PHARYNX.

ACUTE PHARYNGITIS.

Acute pharyngitis may exist as a primary disease, or with any of the infectious diseases, particularly scarlet fever, measles, diphtheria, and influenza. Secondary pharyngitis will be considered in connection with these different diseases.

Acute primary pharyngitis is often attributed to cold and exposure, but it is probable that a large number of these cases will ultimately be shown to depend upon some form of infection. Certain children have a constitutional predisposition to attacks of pharyngitis, and contract it upon the slightest provocation. In some of them there is a strongly marked rheumatic diathesis. Attacks are frequently associated with disturbances of digestion.

In acute catarrhal pharyngitis the inflammation may involve the entire mucous membrane of the tonsils, fauces, uvula, posterior and lateral pharyngeal walls, or any part of it. It may exist alone, or in connection with a similar inflammation in the rhino-pharynx or in the larynx. In the beginning there is seen an acute erythematous blush, usually involving the entire pharynx. This may entirely subside after twenty-four hours, or it may be followed by the usual changes of acute catarrhal inflammation—dryness, swelling, and œdema. Later there is increased secretion of mucus, and finally there may be muco-pus. Occasionally slight hæmorrhages are present.

There is pain at the angle of the jaws, which is increased by swallowing, a sensation of dryness and roughness in the pharynx, and often an irritating cough. There may be slight swelling of the neighbouring lymphatic glands. The constitutional symptoms in young children are often severe. Not infrequently there is a sudden onset with vomiting, and a rise of temperature to 103° or even 105° F. These symptoms are usually of short duration, frequently less than twenty-four hours, and in two or three days the patient may be quite well. In other cases the pharyngitis may be accompanied or followed by laryngitis.

The chief point in diagnosis, when symptoms like the above are seen, is to exclude scarlet fever and measles. A positive diagnosis is impossible until a sufficient time has elapsed for the eruption to come out. The patient should be closely watched for the first sign of its appearance. If scarlet fever is prevalent, a child with the symptoms of severe pharyngitis should at once be isolated while waiting for the diagnosis to be settled. There is commonly less difficulty in excluding measles, for in that disease the early redness is more upon the hard palate than upon the fauces, and usually consists of minute red spots rather than a uniform blush. There is, besides, a history of a previous catarrh for two or three days.

The first step in treatment of acute pharyngitis is to open the bowels freely by means of calomel, castor oil, or magnesia. The child should be kept in bed, and the diet should be fluid, or, in the case of infants, the amount of food should be much reduced. Pieces of ice may be swallowed frequently for the relief of pain and thirst. Internally there may be given two grains of phenacetine every three hours to a child of three years. It is important at the outset to induce free perspiration. The disease is not serious, and the indications are to make the child as comfortable as possible during the short attack. I have seen but little benefit from the use of aconite, although for years I saw it used as a routine treatment.

UVULITIS.

Acute inflammation of the uvula, with swelling and œdema, occurs as a part of the lesion in acute pharyngitis. In rare instances the uvula may be the principal or only seat of inflammation. Huber (New York) has reported two cases, one of which is unique. An infant ten months old was apparently well until two hours before it was seen, when there was noticed a constant irritating cough, accompanied by considerable gagging. A little later there could be seen in the mouth a prominent red mass, which was the enlarged and elongated uvula. It was accompanied by paroxysms of cough, which interfered both with nursing and deglutition. The general symptoms were quite alarming, and the child was in considerable distress. On examination, the uvula was found to be fully one inch long and half an inch wide; it was red and œdematous; in other respects, however, the throat was normal. The symptoms were relieved by multiple needle punctures and the use of ice externally and internally.

ELONGATED UVULA.

Probably this is primarily a congenital condition. It is increased by repeated attacks of acute or subacute inflammation. The degree of elongation differs very much in different cases; in some it may reach an inch in length. According to Bosworth, only the mucous membrane is involved in the elongation. The symptoms are those of local irritation, especially a cough upon lying down, and the sensation of a foreign body in the pharynx. In some cases it may be a reflex cause of asthma, or, more frequently, of catarrhal spasm of the larynx. The diagnosis is very easily made by inspecting the throat. The treatment consists in grasping the tip of the uvula with forceps and cutting off the excess with the scissors, or a uvulatome. Care should be taken not to cut off too much of the uvula, or severe hæmorrhage may occur.

RETRO-PHARYNGEAL ABSCESS.

Two distinct varieties are seen: (1) the so-called idiopathic abscesses which belong to infancy, and (2) abscesses secondary to caries of the cervical vertebræ.

Retro-pharyngeal Abscess of Infancy.—All of the later investigations regarding this disease go to show that primarily it is not a cellulitis, but a suppurative inflammation of the lymph nodes (lymphatic glands) with a surrounding cellulitis. Jules Simon has described the retro-pharyngeal lymph nodes as forming a chain on either side of the median line between the pharyngeal and the prevertebral muscles. These nodes are said to undergo atrophy after the third year, and in some cases to disappear entirely. Retro-pharyngeal abscess—or more properly retro-pharyngeal adenitis, since the process does not invariably go on to suppuration—is probably never primary, but secondary to infectious catarrhs of the pharynx, and is set up by the entrance of pyogenic bacteria. Its pathology is the same as the more frequent suppurative inflammation of the external cervical lymph nodes, with which it is sometimes associated. Usually only a single node is involved, but sometimes two or three are affected, and these may be situated upon opposite sides. I have seen retro-pharyngeal adenitis so severe as to give rise to marked local symptoms, although it did not go on to suppuration. This is rare; Kormann's observations, however, show that swelling of these glands in diseases of the mouth and throat, is very much more common than is generally supposed. Similar abscesses from suppurative inflammation of other lymph nodes in the neighbourhood of the pharynx may occur. I have recently seen one situated between the epiglottis and the base of the tongue.

Etiology.—These cases are almost invariably seen in infancy. Fully three fourths of those that have come under my observation have been in patients under one year. Bokai (Buda-Pesth) reports that of sixty cases observed, forty-two occurred during the first year, eleven during the second year, and only seven at a later period. The primary disease is usually a severe rhino-pharyngitis, or an attack of epidemic influenza, but rarely it occurs as a sequel of scarlet fever or measles. In six hundred and sixty-four cases of scarlet fever, Bokai noted retro-pharyngeal abscess in seven cases. After measles it is even more rare. Retro-pharyngeal abscess usually occurs in winter or spring, on account of the prevalence of the diseases upon which it depends. It is seen in children previously robust, but more often in those who are delicate and who in consequence are prone to severe catarrhal affections.

Symptoms.—The early symptoms in most cases are only those of an ordinary rhino-pharyngeal catarrh. After this has subsided the temperature may remain slightly elevated, often for a week or more, before local symptoms are noticeable. Sometimes, without any distinct history of previous catarrh, there are seen quite high temperature, from 102° to 104° F., loss of flesh, and prostration. A careful examination may be required, and sometimes observation for a day or two, before the explanation of these constitutional symptoms is discovered. In other cases the early constitutional symptoms are so slight as to escape notice, and the physician is summoned on account of the local symptoms, usually the dyspnœa, which in a short time may assume an alarming character. The duration of the inflammatory process before abscess forms is generally five or six days, but it may be two or three weeks. The temperature is invariably elevated, usually from 100° to 103° F.; occasionally it may be 104° or 105° F., with symptoms of prostration seemingly out of all proportion to the local disease, but which are to be explained by the tender age and feeble resistance of the patient.

The first local symptom may be a sudden attack of dyspnœa severe enough to cause asphyxia. This is due to the pressure forward of the abscess which encroaches upon the opening of the larynx. Usually before this occurs the breathing is noisy, especially during sleep, and on account of the obstruction to nasal respiration the patient breathes with the mouth open. The mouth may be dry, or there may be a copious secretion of pharyngeal mucus. The dyspnœa is in most cases greater on inspiration, and in some it is noticed only then, expiration being normal. The dyspnœa is sometimes increased by attempts at swallowing. The degree to which deglutition is interfered with depends upon the size and the position of the tumour. It is more difficult when the tumour is low down. The child may find it impossible to swallow, and in consequence may refuse to nurse; or the difficulty in nursing may depend upon the nasal obstruction. Sometimes there is regurgitation of food through the nose or mouth. The voice is usually nasal. There is not generally hoarseness, but a peculiar short cry which is quite characteristic and which has been compared to the "quack" of a duck. There may be complete aphonia; often there is a short, dry cough. In many of the cases a tumour is to be seen externally, just below the angle of the jaw and in front of the sterno-mastoid muscle. It is rarely so large as to attract attention. The head is thrown back in order to relieve the pressure upon the larynx, and is held somewhat rigidly. In one or two cases I have noticed torticollis as an early symptom.

A positive diagnosis is made by an examination of the throat. On inspection there is seen a distinct bulging of the lateral wall of the pharynx, usually a little above the base of the tongue. The swelling may be so great as to crowd the uvula to one side and nearly fill the pharynx. It is rarely if ever in the median line. There is usually redness of the mucous membrane and œdema of the uvula and of the adjacent parts. On digital examination the swelling is made out even better than by inspection. If it is lower down it may not be visible at all. In the early stage there may be felt only a localized induration or a somewhat diffuse swelling, but by the time the swelling is large enough to produce marked symptoms, fluctuation can generally be discovered.

Prognosis.—When left to itself the abscess usually opens into the pharynx, the pus being swallowed or expectorated. The cavity closes rapidly by granulation, and the patient in a few days is entirely well. It is rare for much burrowing to occur. In young or very delicate infants the constitutional symptoms may be so severe that the child continues to fail even after the evacuation of the abscess, and, gradually sinking, dies usually from broncho-pneumonia. In other children a fatal result is generally due to the fact that the disease is not recognised.

Death before rupture may occur from asphyxia due to pressure upon the larynx or œdema of the larynx, or to rupture of the abscess into the air passages, especially if this occurs during sleep. Carmichael, Bokai, and others have reported deaths from ulceration into the carotid artery or one of its large branches. Carmichael's patient was only five weeks old. The general mortality of the disease is about five per cent; most of the deaths are owing to a failure to make the diagnosis. Gautier has collected ninety-five cases, with forty-one deaths. In my own experience a fatal termination has been very rare; but alarming symptoms have often been present.

Diagnosis.—Retro-pharyngeal abscess is to be suspected if there is difficulty in swallowing associated with dyspnœa or mouth-breathing. A positive diagnosis is possible only by a digital examination of the pharynx. The mistake most often made in diagnosis has been, that the physician, called to a young child suffering from great dyspnœa, has jumped to the diagnosis of laryngeal stenosis, and forthwith performed tracheotomy or intubation, without taking the trouble to get the history or to make a careful examination of the pharynx. Many such cases are reported in which the child has died during the operation or immediately afterward, the autopsy first revealing the nature of the disease. If the possibility of this mistake is kept in mind, the error can hardly be made. A sudden attack of dyspnœa with difficulty in swallowing may also be due to the impaction of a foreign body in the pharynx; but a digital examination in this case will enable one to make a correct diagnosis.

Treatment.—Before the abscess has pointed, hot applications should be made to the throat to relieve the symptoms and to hasten the formation of pus, since resolution is so rare as not to be expected. Spontaneous opening should never be waited for, on account of the danger of the rapid development of serious symptoms from pressure or œdema, or of suffocation from an opening into the air passages, especially during sleep.

As soon as the diagnosis is made the case should be carefully watched, and as soon as well-marked fluctuation is detected, the pus should be evacuated. External incision has few if any advantages and very obvious objections. In opening through the mouth the patient should be seated in an upright position and the head firmly held. A gag should not be introduced, but a tongue depressor may be used, and a bistoury which has been guarded to its point plunged into the abscess at its thinnest point and the incision made toward the median line. The head should then be bent forward, to allow the pus to escape through the mouth. It is well to insert the finger into the cavity and break down any septa; for after a simple puncture the abscess may refill. Incision, although usually easy, in some cases may be quite difficult on account of the swelling and the small pharynx of the infant. For the past few years I have adopted the plan of opening these abscesses with the finger nail, a procedure simple, efficient, and free from danger. While the patient is held as above described, the wall of the abscess is perforated by the nail of the forefinger, which has been sharpened to a cutting point. I have yet to see a case in which this was at all difficult. The amount of pus evacuated is from one drachm to half an ounce. In the majority of cases no after-treatment is required. The relief of the dyspnœa and dysphagia is immediate, and recovery rapid.

An instructive accident, which came near being fatal, occurred in a case at the New York Infant Asylum. An infant seven months old had shown for twenty-four hours stertorous breathing, difficulty in swallowing, and had refused to nurse. Examination showed the presence of quite a large abscess in the right pharyngeal region. A gag was introduced by the house surgeon preparatory to the evacuation of the abscess by incision, when the child became asphyxiated, and respiration ceased although the gag was immediately removed. Intubation was performed, but with a good deal of difficulty on account of the displacement of the larynx, and artificial respiration was required for several minutes before the patient was resuscitated. The abscess was incised half an hour later without the introduction of a gag, and the intubation tube removed. The attack of asphyxia was evidently produced by the stretching of the mouth by the gag, and the increased pressure thereby produced upon the larynx.

Retro-pharyngeal Abscess from Pott's Disease.—This form is rare in comparison with that just described, and under three years of age it is extremely so. These abscesses are usually larger, and the amount of pus contained may be from four to eight ounces. They form very much more slowly, often lasting for months, and, like other secondary abscesses, the constitutional symptoms are seldom severe. The swelling is frequently in the median line, and is not so circumscribed as in the idiopathic cases. The pus often burrows along the spine for several inches.

The symptoms of Pott's disease of the cervical region are usually present for several months before the appearance of the abscess. Sometimes the abscess precedes the deformity, and it may be the first intimation of the existence of bone disease. The local symptoms resemble those of the idiopathic cases, but they develop more slowly, and sudden attacks of fatal asphyxia are very rare. External swelling is usually seen, and it may be quite large, extending almost from one ear to the other, forming a distinct collar. On digital exploration there may be found an irregularity of the anterior surfaces of the cervical vertebræ, and occasionally a marked angular prominence.

When left to themselves these abscesses may open externally in front of the sterno-mastoid muscle, just below the jaw, sometimes nearly as low as the clavicle; they may rupture internally into the pharynx, the œsophagus, or the air passages; or they may burrow a long distance in front of the spine. Death may result from pressure upon the larynx, or from rupture into the larynx, trachea, or pleura; all these, however, are rare. The abscesses not infrequently refill after they are evacuated, and occasionally a discharging sinus is left for many months.

Treatment.—These abscesses should be opened as soon as they are large enough to give rise to local symptoms. The external incision just in front of the sterno-mastoid muscle is generally to be preferred to opening through the mouth, since it gives better drainage, and the after-treatment is more easily carried on; and a sinus opening externally is less objectionable than one opening into the pharynx.

ADENOID VEGETATIONS OF THE VAULT OF THE PHARYNX.

This is a very common and, by the general practitioner, a much neglected condition. It is the source of more discomfort and the origin of more minor ailments than almost any other pathological condition of childhood.

There is a mass of lymphoid tissue situated at the vault of the pharynx which in structure closely resembles the tonsils. It is often spoken of as the "pharyngeal tonsil." Like the faucial tonsils, and under similar conditions, this may become greatly hypertrophied, so as to form a tumour, which may be so large as to fill the rhino-pharynx completely. These tumours have a broad base, and are attached sometimes more to the roof, and sometimes more to the posterior wall of the pharynx. The term *adenoid vegetations* was given to them by Meyer, who first described them in 1868. These growths may be soft, vascular, and spongy, or hard, firm, and fibrous. The first variety is that usually seen in infancy, and the second more often in older children. In a very considerable proportion of the cases there is associated hypertrophy of the tonsils. As a result of the growth there is sometimes present a very high palatine arch amounting almost to deformity.

Etiology.—That condition spoken of in another chapter as the lymphatic diathesis, or "lymphatism," is the one upon which these growths most frequently depend. Often every member of a large family of children is affected, and frequently both parents also. This may occur when there are no other evidences of disease except this tendency. Delicate and rachitic children are, however, more prone than others to this affection. It is most common in damp, changeable climates. The first symptoms usually follow an attack of influenza, measles, scarlet fever, diphtheria, or repeated attacks of ordinary coryza. They generally begin to be troublesome when children are about two years old; there are many cases, however, in which it seems pretty clear that the condition is a congenital one. Many observers hold this view regarding most of the cases.

Symptoms.—The symptoms of adenoid growths are those which relate to the chronic rhino-pharyngeal catarrh and to the mechanical obstruction. In infants and very young children the catarrhal symptoms are apt to predominate; in older children, the obstructive symptoms. The chronic catarrh shows itself by a persistent nasal discharge, which is of a sero-mucous or muco-purulent character, very rarely tinged with blood. This may be continuous, with exacerbations which occur with every fresh cold and with every period of damp weather, or there may be intervals in which the symptoms are absent. In dry weather and in summer the discharge usually ceases entirely, coming on again when the damp weather of autumn and winter returns. This is the condition which underlies the repeated severe head-colds from which so many children suffer every cold season. The symptoms of obstruction are mouth-breathing, nasal voice, and difficulty in blowing the nose, sometimes total inability to do so. The mouth-breathing may be constant, or it may be noticed only during sleep, being accompanied by loud, stertorous respiration. The difficulty in breathing is increased when the child lies upon the back. In consequence of this, children sleep in all sorts of positions—lying upon the face, sometimes upon the hands and knees, and often toss restlessly about the crib in the vain endeavour to find some position in which respiration is easy. Such symptoms should always arouse suspicion of a lymphoid growth in the pharynx. In a case under recent observation the attacks of dyspnœa at night amounted almost to complete asphyxia. The child would rise upon the hands and knees and struggle violently for breath, often without waking; sometimes respiration would cease for several seconds, and he would awake exhausted and covered with perspiration. The mucus and saliva were drawn back and forth until the lips and mouth were covered with a white foam. During the day the symptoms of obstruction may scarcely be noticed. The continued inability to blow the nose, if associated with nasal discharge, should always be regarded as a suspicious symptom. In several cases this has been the first symptom noticed.

Two other symptoms are common in very young children—frequent attacks of otitis and persistent hoarseness or huskiness of voice which may lead to the suspicion that the larynx is the seat of the disease.

In older children and in neglected cases the symptoms are often more marked. The patients are mouth-breathers, both by day and night. The expression of the face is dull, stupid, often semi-idiotic (Fig. 46). Sleep is never deep, and is always accompanied with stertorous respiration and constant tossing from side to side. The voice is thick, nasal, and "wooden." In severe cases nervous symptoms of quite a serious character may be present. The children are languid, listless, sometimes depressed and prone to melancholy, suffering from frequent headaches and from attacks of indisposition, and often passing for very stupid children.

The hearing is impaired in a very large number of the cases. Blake (Boston) found this true of thirty-nine out of forty-seven cases examined, and in thirty-five of these marked improvement in hearing followed operation upon the growths. Deafness may be due to mechanical causes, or to otitis. Where the condition has existed from infancy there is often marked deformity of the chest. There may be simply a marked pigeon-breast and prominent sternum with deep lateral depressions (Fig. 45), or there may be a deep depression over the lower portion of the sternum. Deformities are most marked in rachitic patients. These growths often produce anæmia and general malnutrition owing to the constant interference with sleep and obstruction to respiration, and they may be a reflex cause of many neuroses, such as chorea, incontinence of urine, asthma, catarrhal spasm of the larynx, and sometimes even epileptiform seizures.

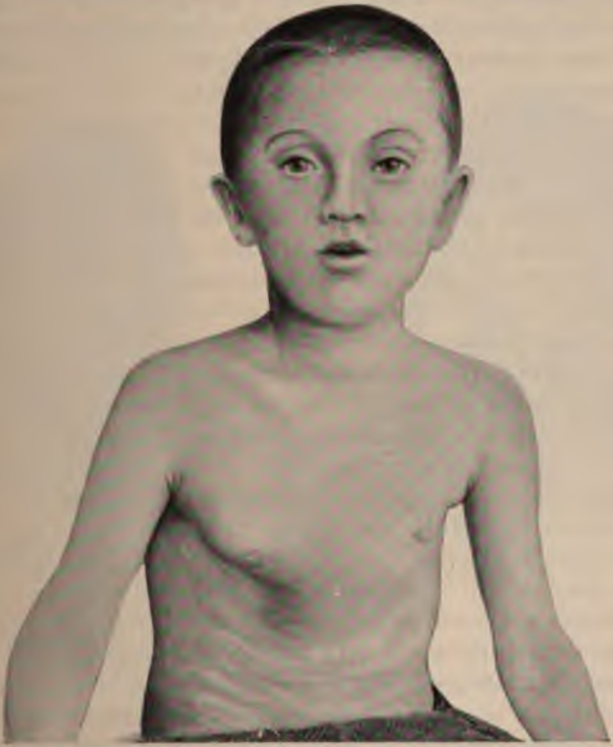


FIG. 45.—Pigeon-breast due to adenoids of the pharynx.

These patients are always better in summer and worse in winter. The natural course of the growths if left to themselves is to increase up to a certain point and then to remain stationary until puberty. After this time they usually undergo atrophy, and the small ones may disappear entirely. In the more severe cases the symptoms persist, aggravated from time to time during attacks of acute catarrh. A removal to an elevated region with a dry atmosphere will often result in a disappearance of all the symptoms, and the growth may cease to increase in size, but unless such a change in residence is permanent the symptoms are liable to return. Under ordinary circumstances there is little or no tendency to spontaneous recovery. Patients with adenoid growths contract diphtheria more easily than do others, and in them attacks of diphtheria, scarlet fever, measles, and whooping-cough are all likely to be more severe.

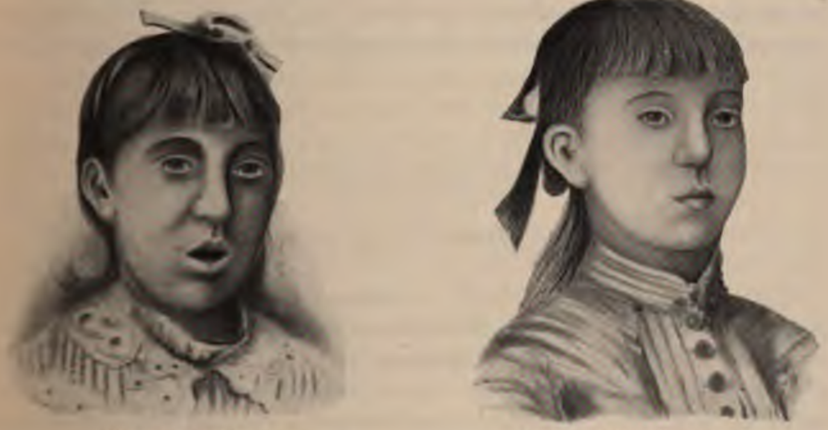
Diagnosis.—In a well-marked case the condition is usually evident from the history, and can scarcely be overlooked. The intractable nasal catarrh, upon which no treatment, local or general, has more than a temporary influence, the mouth-breathing, the disturbed sleep, and the slight deafness—all are characteristic. In some even of the marked cases attention may be drawn to the larynx or to the ears as the seat of disease. At other times the patients come for treatment on account of the general symptoms—the nervous depression, the headaches, or the anæmia. In rare cases the leading symptom may be epistaxis. The symptoms do not always depend upon the size of the growth, for in a small cavity quite a small growth may cause very marked symptoms.

Although the history is in most cases clear, only an examination can make us certain that a lymphoid growth exists. The best method of examination consists in a digital exploration of the pharynx; but this requires a little practice before it is very satisfactory. The head is steadied by the right hand, and the left forefinger is passed up behind the palate. The growth is ordinarily felt as an irregular, soft, velvety mass, and the finger, when withdrawn, is almost invariably covered with blood. The physician must make his diagnosis by the first examination, as the child will allow no repetition. By anterior rhinoscopy, after the use of cocaine, the growth can usually be seen distinctly.

Treatment.—Absorption by internal medication is possible in but few cases. Bosworth reports the best results from the syrup of the iodide of iron, which must be given in doses of from ten to fifteen drops three times a day for a long period. This should be combined with cold sponging and general precautions to prevent a recurrence of colds, and, if possible, the child should pass the winter in a warm, dry climate. These measures may succeed when the growths are small, and where the symptoms are more catarrhal than obstructive. In larger growths and in cases of longer standing, only temporary improvement is likely to follow such treatment. An attempt to reduce by local application, growths of any considerable size, is a waste of time and not to be recommended. My experience has been that, in spite of prolonged local treatment, every marked case has ultimately required operation.

Operation during the spring or summer is generally preferable, but may be performed at any time except during attacks of acute catarrh. Some very expert operators prefer to do without an anæsthetic, and no doubt there are a few of large experience who can operate satisfactorily in most of the cases without anæsthesia. Except for very young children complete anæsthesia is to be preferred, and by chloroform rather than ether. An exception should be made of cases where the growths are small, soft, and very spongy. These may sometimes be rubbed off with the pulp of the finger or scraped away by the finger nail, without giving the patient or friends any idea that an operation has been done; and this can frequently be accomplished under the plea of simply making a digital examination.

The instruments required are Lowenberg's cutting forceps, Gottstein's curette, and a mouth-gag like that used for intubation. After full anæsthesia is reached, the gag is introduced and the soft palate drawn forward by a blunt hook of hard rubber, or, better, by the forefinger of the left hand, which at the same time acts as a guide to the introduction of the forceps. These are introduced closed and passed up along the posterior pharyngeal wall, and the mass seized and torn away piecemeal. The first bite of the forceps will often bring away the greater part of the growth when it is of small size; if large, eight or ten repetitions may be necessary. After the greater part has been removed by the forceps the curette is introduced and the pharyngeal vault scraped clean. In a large number of the cases with growths of small or moderate size, the entire mass may be removed by one, or at most two, applications of the curette, without previously using the forceps. This has the advantage that it can be done much more quickly. In most cases the entire operation does not consume more than two or three minutes. The child is turned upon his face, in order that the blood, which flows freely, may escape from the mouth and nose. The head should be kept low during the operation, to prevent the blood from entering the larynx. Hooper and some other writers prefer to operate with the patient in the sitting posture. Each position has its advantages.



Before operation. Three months after operation.

FIGS. 46 and 47.—Adenoid vegetations of the pharynx; girl twelve years old. (Hooper.)

The dangers of operation are practically none. Excessive hæmorrhage is extremely rare, although there are two or three recorded cases in which serious and even fatal hæmorrhage occurred. Attacks of acute tonsillitis or otitis occasionally develop after operation. No after-treatment is necessary. The patient remains in bed during the day of operation, and in the house for three or four days, or longer if the weather is unpleasant. No local applications are required. It is probably not necessary that every particle of the growth should be removed, since if the major part is taken away, what remains generally undergoes rapid atrophy. A recurrence of the growths is very rare.

The improvement after the operation is in proportion to the severity of the previous symptoms. The respiration is freer; the sleep becomes quiet; the mouth is soon habitually closed; the voice improves; and the benefit to the general health is in a short time apparent. The whole appearance of the child is often transformed in a few months (Figs. 46 and 47).

CHAPTER III.

DISEASES OF THE TONSILS.

THE tonsils* are lymphoid structures closely resembling Peyer's patches, but, instead of having a flattened surface, the lymphoid tissue in the tonsil is folded upon itself, forming quite deep depressions—the tonsillar crypts. These crypts, like the surface of the tonsils, are lined by epithelial cells. They contain lymphoid cells, desquamated epithelium, particles of food, and bacteria. Under normal conditions the tonsils take no part in absorption from the mouth. When, however, their epithelium is rarefied or removed, the tonsils absorb with very great facility every sort of poison which the mouth may contain. Such poisons are taken up by the lymphatics, and through them reach the general circulation.

Acute inflammation of the tonsils, like that of the pharynx, occurs regularly in diphtheria, scarlet fever, and measles, less frequently in the other infectious diseases. The secondary forms will be considered with the diseases with which they are associated.

Acute catarrhal tonsillitis, or inflammation of the mucous membrane covering the tonsils, occurs as a primary disease as a part of the lesion in acute pharyngitis, but very rarely is seen alone. Occasionally the whole mucous membrane covering the tonsils is inflamed and fibrin may be poured out in sufficient quantity to form a distinct pseudo-membrane. These cases, formerly classed as "croupous tonsillitis," will be considered elsewhere under the head of Pseudo-diphtheria.

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* For a critical study of the anatomy and physiology of the tonsil, see paper by Hodenpyl, American Journal of the Medical Sciences, March, 1891.

FOLLICULAR TONSILLITIS.

This is the most frequent and most characteristic form of inflammation of the tonsil. It is essentially an inflammation of the tonsillar crypts, and secondarily of the whole glandular structure.

Etiology.—There is seen in certain children a predisposition to attacks of tonsillitis, so that from very slight exciting causes these occur, sometimes traceable to exposure, sometimes to derangement of the stomach, and sometimes without any evident reason. Children with a rheumatic inheritance appear to be more susceptible than others. One attack predisposes to a second. Patients suffering from chronic hypertrophy of the tonsils are exceedingly prone to acute tonsillitis. It is not very common in infancy, but after this period it is very frequent throughout childhood. The disease, in all probability, begins as an infectious inflammation at the bottom of the crypts, due to the presence of streptococci or staphylococci, which readily enter from the mouth, and excite an attack whenever favourable conditions are present.

Lesions.—As a result of the inflammation, the tonsillar crypts are filled with epithelial cells, pus cells, mucus, and bacteria. These form masses which appear at the mouth of the crypts as small yellow dots, often miscalled ulcers. Sometimes, in addition, fibrin is poured out, and forms, with the other inflammatory products, little plugs which project somewhat from the surface of the mucous membrane, and which can easily be pressed out. Accompanying the changes in the mucous membrane above mentioned, there are acute congestion and swelling of the whole tonsil, with more or less proliferation of the lymphoid tissue. Follicular tonsillitis is always bilateral. Although the pathological process is generally limited to the tonsils, there may be more or less pharyngitis associated.

Symptoms.—The general symptoms usually appear before the local ones, and are often quite severe. The onset is abrupt, with chilly sensations, occasionally a distinct rigour. In infants there is often vomiting, and sometimes diarrhœa. There is pain in the back, in the muscles of the extremities, and in the head. Sometimes there is pain in the lateral cervical muscles. The temperature rises rapidly to 102° or 103° F.; often it touches 104° or 105° F.

The first local symptoms are some swelling of the tonsils and the appearance of isolated yellow spots a little larger than a pin's head. Often these can be wiped off with a swab, or the little plugs can be squeezed out, leaving a slight depression. Later there is acute congestion of the tonsil, with more swelling. Even when the disease is at its height the local pain and discomfort are only moderate, and in many cases scarcely noticeable. The swelling and tenderness of the lymph glands behind the angle of the jaw are not great, and may be absent.

The constitutional symptoms, as a rule, last three days, and are most severe upon the first day. The local symptoms last somewhat longer, but usually by the end of the fourth day the exudate has disappeared, although enlargement of the tonsil may persist for a week or even longer.

Diagnosis.—Tonsillitis may be confounded at its onset with scarlet fever. We must wait for the rash before deciding positively. Its constitutional symptoms in the beginning closely resemble an attack of malaria, influenza, or pneumonia. The great frequency of tonsillitis makes inspection of the throat imperative in every case of acute illness in children. The diagnosis from diphtheria is considered in connection with that disease.

Treatment.—Follicular tonsillitis is a mild disease without danger to life, and one which runs a short, self-limited course. The indications are, therefore, to make the patient as comfortable as possible by the relief of individual symptoms. Older children, particularly those who are rheumatic, should be treated with salol; four grains every three hours being given for the first twenty-four hours, and later smaller doses. In infants this drug is somewhat difficult of administration on account of its tendency to upset the stomach, and had better be omitted. The general aching pains of the first day are best relieved by phenacetine, two grains every four hours to a child three years old. Later it may be used in smaller doses, but enough should be given to make the patient comfortable.

Local treatment is not absolutely necessary, and in infants may be omitted. Older children may use a gargle of boric acid or a weak bichloride solution—i. e., 1 to 10,000. In all doubtful cases the patient should be isolated, and the same treatment adopted as in a case of diphtheria, until all doubt is removed.

PHLEGMONOUS TONSILLITIS—PERITONSILLAR ABSCESS—QUINSY.

This is an inflammation of the cellular tissue surrounding the tonsil, sometimes invading the tonsil itself. It may terminate in resolution, but usually goes on to the formation of an abscess. Phlegmonous tonsillitis is much less common in children than in adults, and, compared with the other forms, it is a rare disease in early life. It is the only variety which is regularly unilateral. In most cases the inflammatory process is circumscribed, but in rare instances there is seen a diffuse phlegmonous inflammation of the pharynx.

In certain patients there exists a constitutional predisposition to the disease, which is often associated with rheumatism. The exciting causes may be exposure, or anything which may reduce the patient's general health, to which there is added local infection. Catarrhal pharyngitis predisposes to this disease.

Symptoms.—The onset resembles that of follicular tonsillitis, except that the general symptoms are usually less marked, the temperature is commonly not so high, and the aching pains and prostration less severe. The local symptoms, however, are more marked. There is very severe pain in the throat, which is increased by deglutition, and finally may be so great that swallowing is almost impossible. It is difficult to open the mouth. There is pain in the lateral muscles of the neck, and often tenderness. In the beginning but little can be seen on inspection, even though the patient complains of a very sore throat. This is always a suspicious circumstance, and should lead one to look out for quinsy. It is due to the fact that the inflammation begins in the deeper tissues, and that the mucous membrane is affected later. After twenty-four or forty-eight hours there is usually quite marked swelling, which is rather more behind the tonsil than elsewhere, pushing it upward and forward; sometimes it is more in front of the tonsil. A little later there is intense inflammation of the mucous membrane covering the tonsil, fauces, and uvula, with marked congestion and œdema; the uvula may be pushed to one side, and the isthmus of the fauces diminished to less than one half its natural size. In one of my own cases marked torticollis was present, and existed for two or three days before the diagnosis of quinsy could be made by the other symptoms.

In most cases the recognition of quinsy is quite easy by attention to the symptoms above mentioned. By inspection of the throat, less information is sometimes obtained than by palpation; by this means a fulness, and later a point of fluctuation, can readily be made out. Acute phlegmonous tonsillitis generally involves no danger to life. In very young infants serious results may follow spontaneous rupture during sleep; and in older children occasionally there may be œdema of the glottis. If not treated, abscess usually forms in from five to seven days, and opens spontaneously.

Treatment.—If an early diagnosis is made an attack of quinsy may occasionally be aborted. For this many drugs have been advocated, but to my mind the best is salol, which should be given in doses of two grains every two hours to a child of five years. In some patients larger doses may be used. This may be combined with small doses (gr. ¼) of Dover's powder. Relief may be afforded by very hot or cold applications, according to the sensations of the patient. The holding of ice in the mouth and the application of an ice-bag externally, often give great comfort. In other cases, gargling with very hot water and the application of hot flaxseed poultices externally, will be preferred. As soon as fluctuation is detected an incision should be made with a guarded bistoury. If made too early, only a small amount of pus is evacuated and the abscess may refill. After spontaneous rupture the relief to symptoms is usually immediate.

CHRONIC HYPERTROPHY OF THE TONSILS.—CHRONIC TONSILLITIS.

The condition known as chronic hypertrophy, is a permanent enlargement due to a proliferation of the lymphoid tissue of the tonsils, and an increase in the connective-tissue stroma. If the increase in the connective tissue is slight, the tonsil is soft; if it is great, the tonsil is firm and hard, almost like a fibrous tumour. All degrees are found. Associated with hypertrophy of the tonsils there are frequently found adenoid growths of the pharynx, both of these depending upon similar local and constitutional conditions. There is in nearly all marked cases a chronic pharyngeal catarrh which may involve the Eustachian tubes.

Etiology.—Hypertrophy of the tonsils is an exceedingly common condition in the cities of the seacoast and lake districts of the temperate zone. In a routine examination of 2,000 New York school children, Chappell found enlargement of the tonsils sufficiently marked to be considered pathological, in 270 cases. The causes are constitutional and local. The constitutional causes relate to the conditions described in the chapter upon Lymphatism. This is often found in certain families for several generations. The condition is not connected with tuberculosis. It occurs in children who are in other respects healthy. Hypertrophy of the tonsils is often a congenital condition, increasing slowly during infancy, so as to produce marked symptoms by the time the child is two years old. The most important of the local causes are attacks of acute or subacute pharyngitis. While it is true that attacks of acute inflammation are often the cause of hypertrophy, it is also true that hypertrophy is one of the most frequent predisposing causes of acute attacks, and that it may be seen in children who have never had tonsillitis.

Symptoms.—Hypertrophy of the tonsils is rarely marked enough to cause any decided symptoms before the end of the second year, although I once saw in a younger child enlargement sufficient to bring the two tonsils into contact. The most important local symptoms, formerly ascribed to hypertrophied tonsils, are now known to depend upon adenoid growths of the pharynx. As these conditions are so frequently associated, it is somewhat difficult to determine which symptoms are due to the tonsils alone. In a marked case, the most prominent symptoms are mouth-breathing, disturbed sleep accompanied by snoring, and nasal voice—the patient in some cases talking as though he had food in his mouth. There may be some difficulty in swallowing solid food. Enlarged tonsils may often be felt externally. As a consequence of the obstruction of the Eustachian tubes there may be deafness. Deformities of the chest, such as pigeon-breast, are occasionally seen, but probably depend more upon obstructed respiration by adenoids than by the tonsils.

The soft tonsils may diminish somewhat in size spontaneously. They sometimes shrink very decidedly after an attack of acute tonsillitis, scarlet fever, or diphtheria. As a rule the tonsils become firmer and harder as time passes. They usually increase in size up to a certain point, and then remain nearly stationary until about puberty, when they may diminish considerably. During intercurrent attacks of inflammation, the swelling is much increased and the symptoms are proportionately aggravated. In cases of marked enlargement very little spontaneous improvement is to be looked for during childhood.

Treatment.—Very large tonsils are a source of continued danger to the patient, and in every case of marked hypertrophy treatment should be advised. The danger may be from Eustachian catarrh and deafness, or from repeated attacks of acute tonsillitis. But quite as important as these is the fact that they increase the liability to contract diphtheria, and add to the dangers both of diphtheria and scarlet fever. If the patient is removed from the locality in which acute tonsillitis is likely to occur, to a high, dry climate, considerable improvement is likely to result in a young child in whom the tonsils are soft, but not much is to be expected in older children with hard, fibrous tonsils, except, perhaps a cure of the accompanying pharyngeal catarrh.

The only internal remedy offering much chance of benefit is, in my experience, the syrup of the iodide of iron, which must be given in quite large doses (twenty drops three times a day to a child of five years), and continued for several months. In a small number of cases marked improvement is seen from this treatment, but in the majority but little change occurs. Astringent applications may accomplish something in recent, but practically nothing in old cases. In a marked case, operation is the only thing which can be relied upon to effect a cure. In those in which it is decided not to operate, or in which operation is refused, a faithful trial may be made with the other measures referred to. The question to be decided always is whether or not operation shall be done. For convenience of consideration, the cases may be divided into three groups: (1) those in which the tonsils are nearly or quite in contact;(2) those in which they project not more than one fourth of an inch beyond the faucial pillars; (3) the intermediate cases. All of the first group should unquestionably be operated upon, unless the patient's general condition is such as to forbid operation of any kind. Of the second group, few if any require operation. Whether an operation is done in the third group will depend upon the individual case. If there are frequent attacks of acute tonsillitis, and some deafness, an operation should be performed. If little or no local discomfort is experienced it may be postponed.

Of the various operations proposed, excision with the guillotine is the one which has in children superseded all others in the practice of New York physicians. The risk of hæmorrhage at this age is very slight.

The child is held as for the operation of intubation, except that the head is thrown backward. No after-treatment is required, excepting fluid diet and confinement to the house for two or three days. Excessive hæmorrhage may be controlled by digital pressure, or by the application of styptic cotton upon a swab; in extreme cases, by transfixing the tonsil stump with a hare-lip pin and the application of a ligature. I have more than once seen physicians greatly alarmed at the gray wound on the day following tonsillotomy, the appearance being such as to lead in several cases to the diagnosis of diphtheria. This mistake will not be made if the possibility of it is borne in mind. It is seldom that any but good results follow the operation of tonsillotomy if properly performed. It is too often neglected. Where adenoids of the pharynx are also present, the symptoms may depend more upon them than upon the enlarged tonsils, and little benefit is seen until the adenoid growths also are removed. Both may be operated upon at a single sitting, or at two sittings if preferred.

It is not usually necessary to remove the tonsil to a point even with the faucial pillars, but the more nearly we can come to this the better. The amount of shrinkage from cicatrization after operation has been, in my experience, generally less than was expected. As a rule, enlargement of the tonsil subsequent to an operation is not seen; but one should be careful about promising parents that it will not occur. I have seen it in two or three instances to a striking degree, and think it more likely to occur if children operated on are very young—i. e., before the third year.

CHAPTER IV.

DISEASES OF THE ŒSOPHAGUS.

MALFORMATIONS.

CONGENITAL anomalies of the œsophagus are much less frequent than those of the lower part of the respiratory tract, with which, however, they are often associated.

There may be, (1) Congenital fistula of the neck, due to a want of closure between the second and third branchial arches. This gives an external opening just above and to the outside of the sterno-clavicular articulation, which communicates with the upper part of the œsophagus or the lower part of the pharynx. (2) The œsophagus may be absent, the pharynx ending in a blind pouch. (3) The œsophagus may be obliterated in certain portions, being represented only by a fibrous cord. (4) There may be stenosis and dilatation or diverticula. (5) There may be a fistulous communication with the trachea, existing either alone or associated with some of the other deformities mentioned.

Congenital narrowing of the œsophagus and fistula of the neck are amenable to surgical treatment. The cases of complete obstruction in the œsophagus are almost of necessity fatal, the patients dying from inanition two or three days after birth.

The symptoms of œsophageal obstruction are regurgitation on attempts at swallowing and the impossibility of passing the stomach tube.

ACUTE ŒSOPHAGITIS.

It is quite remarkable, considering the frequency of pathological processes in the pharynx, that these so rarely extend to the œsophagus. Thrush, when very extensive in the pharynx, may involve the upper part of the œsophagus; but there it gives rise to new symptoms. Diphtheria and pseudo-diphtheria of the pharynx may invade the œsophagus, but this is seen only in very rare instances. In about seventy-five autopsies which I have seen in cases of diphtheria, the œsophagus was involved in but one, and in this case for three or four inches only. Diphtheria of the œsophagus produces no symptoms, and can not be diagnosticated during life.

Catarrhal Œsophagitis is very rarely met with. It may be caused by lacerations due to swallowing a foreign body, which may excite a simple catarrhal inflammation, or, if the foreign body is sharp and angular, lacerations may be produced which result in ulcerations of variable depth. The chief symptoms of catarrhal œsophagitis are soreness and pain on swallowing. These lacerations, when slight, are healed in a few days, and are rarely followed by any after-effects.

Corrosive Œsophagitis.—This is altogether the most frequent form, and the only one which is of clinical importance. The usual causes are the same as of corrosive gastritis, viz., the swallowing of caustic alkalies or strong acids. It is often in the œsophagus that the most extensive injury is done. The effects are superficial or deep, according to the amount of the irritant swallowed and its degree of concentration. There may be simply a destruction of the epithelial layer, which is followed by no serious consequences, or the mucous membrane may be destroyed and the submucous coat invaded; rarely, however, does the injury extend to the muscular layer. If the patient survives the dangers incident to the irritant poisoning and the acute inflammation which follows, healing by granulation and cicatrization takes place, the contraction of the cicatrix gradually narrowing the lumen of the œsophagus until stricture is produced.

The early symptoms of corrosive œsophagitis are mingled with those of inflammation of the mouth, pharynx, and stomach. There is a burning pain in the parts, great thirst, spasm of the œsophagus on attempts at swallowing, so that deglutition may be almost impossible. There follows a period of acute inflammation of several days' duration, in which the chief local symptoms are dysphagia and pain, and in which the principal danger is that of suffocation from œdema of the glottis. After this period has passed, the patient may be comparatively well until the symptoms of stricture begin, usually in from three to six months after the injury.

The indications for treatment in the early stage, are to neutralize the caustic in order to prevent if possible its deep action, and in all cases to give oils, demulcent drinks, and ice for the local effect, and morphine for the pain.

The treatment of œsophageal stricture is purely surgical, and for this the reader is referred to surgical text-books.

RETRO-ŒSOPHAGEAL ABSCESS.

Retro-œsophageal abscess may result from the breaking down of tuberculous lymph nodes in the posterior mediastinum, and may give rise to symptoms like those which result from an abscess due to Pott's disease, from which it can not be diagnosticated. Retro-œsophageal abscess or peri-œsophagitis may occur in children after measles, scarlet fever, influenza, or with syphilis. Here its pathology is the same as retro-pharyngeal abscess, differing only in location. Retro-œsophageal adenitis, or enlargement of the lymph nodes in the posterior wall of the œsophagus, not going on to suppuration, is a rare condition. I have recently met with a case in which a tumour nearly an inch in diameter was formed at the upper part of the œsophagus, and which caused pressure symptoms, necessitating tracheotomy. The growth was at first believed to be of a malignant character, but it completely disappeared after four or five months of general treatment, including a summer in the country.

Perforation of the œsophagus, and a food-fistula connecting the œsophagus and the trachea, may result from ulceration caused by a tracheal canula or by a foreign body. This may be accompanied by abscess.

The most common variety of retro-œsophageal abscess is that due to Pott's disease of the lower cervical or upper dorsal region. The symptoms are obscure, and an exact diagnosis is not often made during life. Death may occur quite suddenly where the previous symptoms have been so slight as to be easily overlooked. The following is a fair example of such a case:

A little girl two years old, of a tuberculous family, was admitted to the Babies' Hospital in December, 1892, with spinal caries of the upper dorsal region. The symptoms were of two months' duration, and already there was a spinal deformity consisting of a small knuckle. The patient was kept in bed and a plaster-of-Paris jacket applied. A slight febrile action of irregular type was present. About a month after admission dyspnœa was first observed; this was at times quite intense, and again almost absent. It was always on inspiration, expiration being easy. No explanation for this was found in the lungs. There was no difficulty in swallowing, and very little cough. After these symptoms had lasted for about a week, the child while eating was suddenly seized with violent dyspnœa, and in a few moments became completely asphyxiated. Tracheotomy was immediately done, and by means of artificial respiration the patient was restored to comparative comfort. About two hours later a second attack occurred, and the patient died in an hour. At the autopsy there was found an abscess a little larger than a hen's egg, containing about two ounces of curdy pus, overlying the bodies of the first three dorsal vertebræ and communicating with them. These vertebræ were carious. The right pneumogastric nerve, an inch and a half above the bifurcation of the trachea, was compressed between the abscess and a large tuberculous lymph node, with the capsule of which it was blended. In the lungs were a few small tuberculous deposits and the usual conditions found in death by asphyxia. The dyspnœa seems to have been of nervous and not of mechanical origin, and caused by irritation of the pneumogastric. The fatal issue was apparently from an increase of the pressure upon the nerve.

A case almost identical with this has been reported by Chapin, and others quite similar by Ripley, Richards, and Jarisch. In none of these was difficulty in swallowing present, probably because the œsophagus was compressed only upon one side. In all there were symptoms of irritation of the pneumogastric, or the recurrent laryngeal branch—stridulous breathing, inspiratory dyspnœa, and spasmodic cough, with or without slight hoarseness. In one case only was there aphonia. After such symptoms as these have existed for a few days or weeks there usually comes a sudden attack of asphyxia. The first attack may be fatal, or there may be several of a milder character before the fatal one. In two cases this followed a full meal, probably from the increase of pressure due to distention of the stomach. In two cases tracheotomy was done, but gave temporary relief only.

The diagnosis of this condition is very difficult, and a positive diagnosis almost impossible. It may be suspected in cases of Pott's disease of the lower cervical or upper dorsal regions, when there is spasmodic inspiratory dyspnœa, especially if accompanied by irritative cough. It should, however, be remembered that precisely similar symptoms may depend upon the irritation of a tuberculous node, and that the sudden asphyxia is exactly like that caused by the ulceration of such a node into the trachea or a large bronchus. The latter, however, may occur without the presence of Pott's disease. If the abscess is higher up, there may be a lateral swelling on either side of the neck, just above the clavicle. In most of the cases there are no external signs of disease. Such abscesses are too low to be reached by digital examination of the pharynx. The attack of asphyxia may also be confounded with that due to the presence of a foreign body in the larynx.

The prognosis in cases of retro-œsophageal abscess is exceedingly bad. Death usually results from pressure upon the pneumogastric, as in the cases reported. The abscess may rupture into the œsophagus and recovery follow. This termination is very rare, but such a case has been reported by Knight. A fatal one is reported by Löschner and Lambl. The abscess may burrow along the œsophagus into the abdominal cavity and excite peritonitis; finally, it may open externally.

But little is to be said under the head of *Treatment.* The symptoms are rarely definite enough to justify a radical surgical operation. Tracheotomy gives but temporary relief to the asphyxia. This operation should be performed, however, in every case, because of the impossibility of making an exact diagnosis of retro-œsophageal abscess from other conditions in which the operation might be curative.

CHAPTER V.

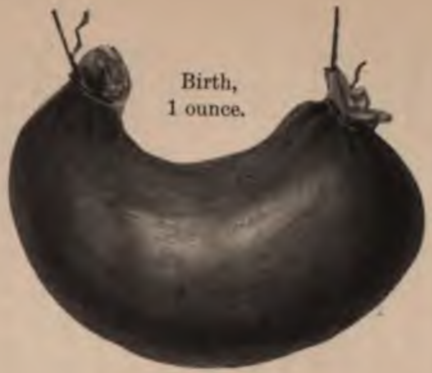
DISEASES OF THE STOMACH.

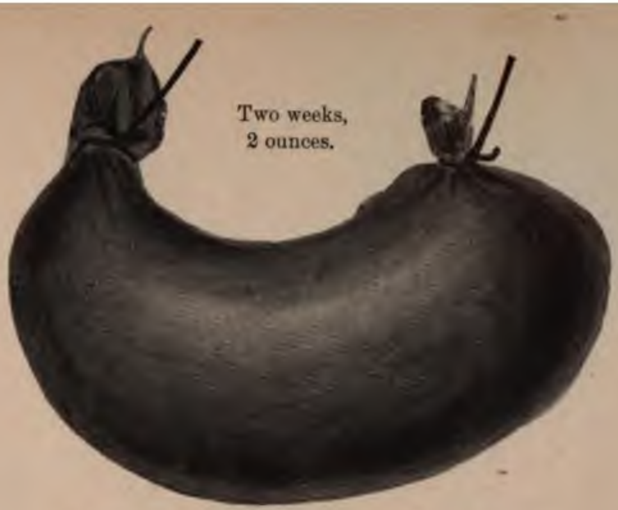
It is difficult, wholly to separate diseases of the stomach from those of the intestines. Although in older children they are often quite distinct, in infancy they are more frequently associated; but at one time the gastric symptoms may be prominent, and at another the intestinal symptoms. Functional disorders particularly, are likely to involve the whole tract. Serious organic lesions are more frequently limited in their extent either to the stomach or to the intestine. The former are rare, while the latter are very common. The diseases in which the stomach is alone or chiefly involved will be considered by themselves. Those in which both the stomach and intestine are involved are classed with the intestinal diseases, as the intestinal symptoms usually predominate.

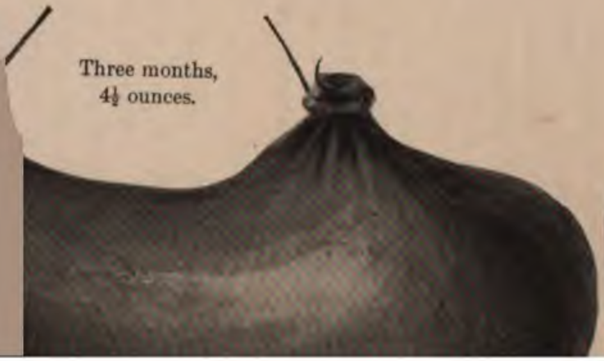
DIGESTION IN INFANCY.

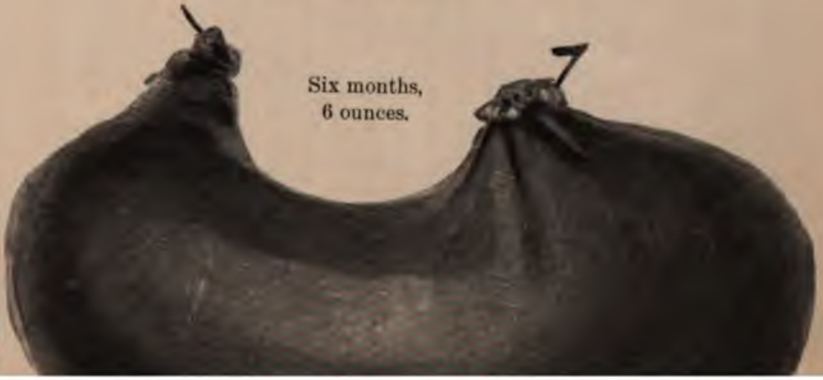
The first step in the process of digestion in the newly-born infant is sucking. During this act the nipple is grasped between the lower lip and tongue below, and the upper lip and jaw above. The back of the mouth is closed by the fall of the palate. A strong downward movement of the lower jaw rarefies the air in the mouth, and produces the suction force which causes the milk to flow. Sucking can be carried on only when the nose is free for respiration and the palate and upper jaw intact. Children with deformities of the mouth, like cleft palate and harelip, suck only

PLATE VII.


Birth,
1 ounce.


Two weeks,
2 ounces.


Three months,
4½ ounces.


Six months,
6 ounces.

with the greatest difficulty, and complete nasal obstruction prevents nursing.

The Saliva.—This is present at birth only in very small quantity, and the part which it plays in digestion in early infancy is an insignificant one. During the third and fourth months it increases markedly in amount, and at this time it possesses quite actively the power of transforming starch into sugar. This property is present only to a very slight degree during the first eight or ten weeks. With the advent of the teeth there is a further increase in the amount of saliva secreted, indicating a change in the digestion of the infant.

The Stomach.—The position of the stomach in the fœtus is nearly vertical. In the newly-born child it lies obliquely in the abdomen, and at the end of infancy has almost reached the transverse position. The stomach at birth is nearly cylindrical, but the fundus increases quite rapidly during the first year, although it does not reach its full development until quite late in childhood. In Plate VII are shown the actual size and shape of the stomach at the various periods of infancy. In the following table are given the results of post-mortem measurements of the stomach, which I have personally made in ninety-one infants under fourteen months of age:

The Capacity of the Stomach.

AGE.	Number of cases.	Average capacity.	AGE.	Number of cases.	Average capacity.
Birth..............	5	1·20 oz.	12 weeks	6	4·50 oz.
2 weeks............	7	1·50 "	14 to 18 weeks...	12	5·00 "
4 "	4	2·00 "	5 to 6 months...	14	5·75 "
6 "	11	2·27 "	7 to 8 " ...	9	6·88 "
8 "	4	3·37 "	10 to 11 " ...	7	8·14 "
10 "	2	4·25 "	12 to 14 " ...	10	8·90 "

In brief, the average capacity was, at birth, one and one fifth ounce; at three months, four and a half ounces; at six months, six ounces; at twelve months, nine ounces.

Gastric digestion.—The part taken by the stomach in digestion is smaller than was formerly supposed, and not so important in infants as in adults. The food leaves the stomach so rapidly that a large part of the casein must pass into the intestine before it is converted into peptones. The opinion has been steadily gaining ground that the function of the stomach is largely that of a reservoir, into which the milk is received and from which it is allowed to pass gradually into the intestine; and that the gastric process is only a preliminary and partial one, even in the digestion of proteids, this being completed in the intestine.

The only part of the food acted on in the stomach is the proteids, which are transformed successively into acid-albumin, albumoses, and peptones. This is accomplished by the agency of the pepsin and the acid of the gastric juice—generally hydrochloric acid, although lactic acid may take its place. Pepsin is found in the stomach at birth, and even in the embryo as early as the fourth month (Krüger). The reaction of the stomach in fasting is acid, and at this time usually free hydrochloric acid can be demonstrated. Soon after a meal of human milk it is alkaline or neutral; after one of cow's milk it is acid or neutral. In fifteen minutes after feeding the reaction is always acid (Leo). Free hydrochloric acid can not usually be demonstrated until about an hour after feeding, then only in small quantities, and in very many cases not at all. Some good observers go so far as to say that in health free acid is never found during digestion. The reason for this apparently is, that the acid combines with the casein of the milk, that of cow's milk in particular having a very great power of combining with hydrochloric acid.

Lactic acid is feebler in its digestive power than hydrochloric acid. It is more abundant early in infancy than later, and its source is the milk sugar. It is rarely found as free acid; never in health, according to many observers.

The coagulation of milk in the stomach is accomplished through the agency of the rennet ferment (the lab-ferment of Hammarsten). This is independent of both the pepsin and the acid of the stomach. It acts in acid, alkaline, and neutral media. Coagulation is the first change in the milk in the stomach. Human milk coagulates in loose flocculi and quite imperfectly, more firmly if the stomach is very acid. Cow's milk, unless diluted, coagulates in firm, compact masses. Under the influence of pepsin and hydrochloric acid, solution of this coagulum now begins; but this is only partially accomplished in the stomach. It goes forward much more rapidly in the case of human milk, because the amount of casein is less and because of the smaller curds. The milk begins to leave the stomach very soon after the meal, and even during the first half hour a considerable part passes into the intestine. At the end of an hour the stomach in a young infant is often empty. In the case of cow's milk, not only are the coagula firmer, but the amount of casein present is much larger, and hence the milk is detained in the stomach a longer time; even then a considerable portion of it must pass but little changed into the intestine.

The duration of gastric digestion varies with the age of the infant and with the food. During the first month the stomach of healthy nursing infants is usually found empty in an hour and a half after feeding; often after one hour. In those taking cow's milk the average is at least half an hour longer. In infants from two to eight months old the average is two hours for those receiving breast milk, and two and a half to three hours for those fed upon cow's milk. This is influenced by the size of the meal taken. This period is very much longer in all cases of disordered digestion.

The bacteria of the stomach are very few as compared with the intestine, and no varieties are constantly present (Booker).

The Intestines.—The length of the small intestine at birth is about nine feet; that of the large intestine about eighteen inches. The great length of the sigmoid flexure is the most striking peculiarity, this being nearly one half the length of the large intestine. (See page 64).

Intestinal digestion.—All the important elements of food—proteids, carbohydrates, and fats—are acted upon by the pancreatic juice. The proteids are converted into peptones by the trypsin, which is active only in an alkaline medium. How much of the proteids of the milk is left for intestinal digestion, depends upon how well the stomach has done its part. In every case something is left; in most cases a large part of the proteids passes but little changed into the intestine. The diastatic ferment of the pancreas has the power of converting starch into sugar. This action is feeble during the first six months, and, according to Koronin and Zweifel, it is entirely absent in early infancy. Fats are emulsified by a third ferment in the pancreatic juice, in connection with bile, which probably furnishes the needed alkali. Some of the fats are also saponified. The pancreatic juice actively emulsifies fat, even at birth.

The very large size of the liver in the newly born indicates how important are its functions in digestion. The biliary secretion is present as early as the third month of fœtal life (Zweifel). Bile assists in the digestion and absorption of fats, as has already been mentioned. In addition it is a stimulus to peristalsis, and in this way aids in the absorption of all kinds of food. Its antiseptic effect is very doubtful. It has a feeble diastatic action upon starch. The greater part of the bile is reabsorbed from the intestine.

Milk sugar is changed into galactose (Biedert), cane sugar into dextrose and levulose, all three being closely allied substances. Through what agency these changes are accomplished is not now positively known, but it is probably the pancreatic juice.

The action of the intestinal juice is not perfectly understood; its chief function is thought to be diastatic. It is alkaline in reaction, and probably facilitates the action of the trypsin, the diastatic ferment, and the absorption of fats.

Absorption.—From the stomach, absorption of water, salts, sugar, and peptones may take place directly into the blood. From the small intestine, in addition to the above elements, fat is absorbed especially by the villi. Absorption is less active than secretion in the small intestine, except in the duodenum. It is accomplished through the agency of the villi and the simple follicles of the mucous membrane. It is perhaps partly by filtration and endosmosis, but chiefly through the activity of the epithelial cells themselves (Hoppe-Seyler, Haidenhain). Absorption from the large intestine is quite imperfect. There are no villi, and hence fat absorption is very slight. Sugar, salts, and peptones, however, may be absorbed with moderate facility. Since there is little or no digestive activity in the large intestine, if this is used as a means of nutrition, the food must be given in a condition in which it is ready for absorption.

Even in healthy nursing infants complete absorption takes place only of the milk sugar. From two to five per cent of the proteids and fats taken, pass through the intestinal canal. In infants taking cow's milk the fat-residue is from one to three per cent greater than in those who are breast-fed (Uffelmann). Even when the amount of fat given is considerably greater than that usually present in cow's milk, it may be almost entirely absorbed. In infants taking cow's milk the proteid residue is relatively much greater than that of the fat.

In cases of indigestion the increase in the food-residue in most cases is first in the proteids, next in the fat, and least in the sugar. In some of the chronic cases the principal increase may be in the fat-residue.

Intestinal Bacteria.—For the fundamental work upon this subject we are indebted to the researches of Escherich. Bacteria are absent from the entire gastro-enteric tract at birth. They quickly enter by the mouth, and by the end of twenty-four hours they are usually found in all parts of the intestinal tract. The meconium-bacteria are derived from the inspired air, and hence vary somewhat with surroundings. As soon as the ingestion of milk begins these varieties are displaced, and throughout the period in which the infant has this food exclusively, there have been found in healthy conditions but two varieties which are constantly present. These are the *bacterium lactis aerogenes* and the *bacterium coli commune.* The first is found most abundantly in the upper part of the small intestine, diminishing as we descend, in small numbers only in the colon, and usually none are in the fæces. It seems to require for its growth the presence of milk sugar, hence its absence from that part of the intestine where milk sugar is not found. Milk sugar is decomposed by it with the formation of lactic acid (acetic, according to Baginsky), carbon dioxide, hydrogen, and methane. This action is not hindered by the bile. The *b. lactis* has no action of importance on either the fat or casein of the milk.

The *b. coli commune* is found in but small numbers in the upper small intestine, becoming more abundant as we descend. In the colon and in the fæces it is present in immense numbers, and in the fæces is sometimes almost the only variety. The activity of the *b. coli commune* apparently begins where that of the *b. lactis* ends, viz., in the lower part of the small intestine. It does not seem to depend for its growth upon any part of the food, but upon the intestinal secretions. A change from a milk diet to a mixed diet of meat and farinaceous food, produces a constant change in the bacteria of the intestine. The *b. lactis* disappears;

the *b. coli commune*, however, continues to be found as the principal form of the colon.

Regarding the meaning of these bacteria but little is as yet known. We do not know whether they are essential to healthy digestion or prejudicial to it. The *b. lactis* is believed not to be pathogenic. There seems to be accumulating evidence in favour of the view that the *b. coli commune*, though not ordinarily pathogenic, may under certain conditions become so.

Fæces.—The first discharges after birth are called meconium; this is of a dark brownish-green colour, semi-solid, and usually passed from four to six times daily during the first two or three days. On the third day the stools begin to change in character, and by the fourth or fifth day they have usually assumed the appearance of healthy milk-fæces. Under many abnormal conditions the stools may continue to have the character of meconium for a week or more. The composition of meconium, according to Forster, is intestinal mucus, bile, the vernix caseosa, epithelial cells from the epidermis, hairs, fat-globules, and cholesterin crystals. For its formation there are necessary the secretions of the intestine and the liver and the swallowing of a considerable amount of amniotic fluid.

Milk-fæces.—The normal amount of fæces discharged daily by a healthy nursing infant is from two to three ounces. Such stools have the colour of the yolk of egg. They are smooth, homogeneous, of a soft, butter-like consistency, with an acid reaction, and a slightly acid but not unpleasant odour. The reaction is due to the presence of fatty acids (Biedert) or lactic acid (Uffelmann). The colour depends upon bilirubin. The stools of an infant fed upon cow's milk may differ in no respect from those described; they are, however, commonly firmer, paler, and may be neutral or even alkaline in reaction, depending upon the decomposition of casein. In fact, all these differences depend chiefly upon the presence of undigested casein.

The only gases present are hydrogen and carbon dioxide (Escherich). Sulphuretted hydrogen and marsh gas, to which the odour of adult stools is largely due, are not present. The following is the chemical composition as given by Wegscheider:

Water			85·13
Solids	Organic	13·71	14·87
	Inorganic	1·16	
			100·00

The proteids of breast milk are almost entirely absorbed. According to Uffelmann, they form but 1·5 per cent of the dry residue of the fæces. The stools of infants fed upon cow's milk are usually larger, and invariably contain casein. If the casein in the milk as fed is excessive, it may be present in the fæces in large amount, the stools then being of a pale yellow or white colour, quite dry, often formed, and with an odour sometimes cheesy, at other times foul.

Fat is always present, and forms, according to Wegscheider and Uffelmann, from 9 to 25 per cent of the dry residue of milk fæces. According to Tschernoff and some other recent observers, the proportion is as high as 28 to 35 per cent. It is present as neutral fat, fatty acids, and soaps. Sugar is not found, but its derivative, lactic acid, may be present in a small amount. Inorganic salts form about 8 per cent of the dry residue. They are chiefly the salts of lime. Of the biliary elements there are hydrobilirubin, unchanged bilirubin, and cholesterin in considerable amount. The presence of biliary acids is doubtful. Mucus is always present in considerable quantity; also columnar intestinal epithelium. Leucin, tyrosin, and other products of albuminous decomposition—phenol and skatol—are absent; indol is rarely found (Uffelmann).

Microscopically there are seen epithelial cells, chiefly of the columnar variety, a few round cells, mucous corpuscles, fat-globules and crystals of fatty acids, cholesterin, mucin, protein substance, crystalline inorganic salts, sometimes bilirubin in crystals, yeast fungi, and bacteria in immense numbers, chiefly the *b. coli commune.*

If the infant is taking a food containing starch, this will appear to a greater or less extent in the stools, a larger amount in the case of very young infants. Starch is recognised by the blue reaction with iodine, or the violet reaction if the starch has been converted into dextrine, as is often the case. Starch granules may be seen under the microscope.

The number of stools during the first two weeks is from three to six daily. After the first month two stools a day are the average; many infants have three, many others but one.

As soon as an infant is put upon a mixed diet, the peculiar characters of the stools cease, and they come to resemble more closely those of the adult, though remaining softer throughout infancy. They become darker in colour and assume the adult odour, while retaining their acid reaction. The bacteria, while still in great numbers, are no longer of the single variety met with almost exclusively in milk-fæces.

MALFORMATIONS AND MALPOSITIONS OF THE STOMACH.

These are much less frequent than those of other parts of the alimentary tract. There may be atresia or stenosis at either orifice, usually the pyloric; still more rarely a constriction has been found near the middle of the organ, dividing it into compartments. The symptoms of atresia at either orifice are persistent vomiting, and death in a few days from inanition. The stomach is sometimes in the thoracic cavity in cases of diaphragmatic hernia. It may be found in a vertical (fœtal) position, variously adherent to the colon and small intestine.

VOMITING.

Vomiting is exceedingly frequent in infants and young children, and although seen in many forms of disease, it is the one particular symptom to attract attention to the stomach. The physician must have in mind both its common and its uncommon causes. Vomiting takes place with great facility in young infants even from slight causes, owing to the position and shape of the stomach.

1. *Vomiting from overfilling of the stomach.*—This is often seen in nursing infants, and there may be no other symptom of disease. It is characterized by the fact that it comes within a few minutes after nursing, that it is easy and without effort, and that the food is but little changed. It may be excited by moving the child or making undue pressure upon the stomach. It often comes with eructations of gas or air which has been swallowed. Vomiting from overdistention may be regarded as a safety-valve, and requires no treatment except to diminish the quantity of food.

2. Vomiting is almost invariably present in cases of *acute gastric indigestion*, whether there is inflammation of the stomach or not. It does not usually come immediately after feeding, and it may be delayed for several hours. It is often preceded by fever and by marked prostration, which in young infants may approach collapse. It may cease when the contents of the stomach have been evacuated, but often mucus, serum, and, in severe cases, bile, may be vomited for some time afterward. In these cases vomiting is due to the irritation of undigested food, and to the exaggerated reflex irritability of the stomach from congestion of the mucous membrane.

3. In *acute intestinal obstruction* vomiting is rarely absent, and in most cases it is persistent. In the newly born, persistent vomiting is almost invariably dependent upon congenital obstruction of the intestine, which is most frequently in the duodenum. In malformations of the colon and rectum it is less constant and appears later. In intussusception, vomiting is forcible, immediately excited by the taking of food, and is at first bilious, but later may become fæcal. The vomiting in intestinal obstruction is associated with general symptoms of marked prostration, and usually with obstipation.

4. Vomiting is a frequent and almost a constant symptom of general *peritonitis*. It is then associated with abdominal distention, tenderness, and fever.

5. In certain *nervous diseases*, especially tumour of the brain and acute meningitis whether simple or tuberculous, vomiting is very common. It may be the earliest, and for some time the only marked symptom. As in the vomiting from intestinal obstruction, this is likely to be sudden, forcible, or projectile. It may occur after taking food, or it may have no rela-

tion to meals. The vomited matters are not characteristic, and the tongue may be clean. Headache, dulness, slight fever, constipation, and irregular pulse and respiration are usually present sooner or later, and serve to make the diagnosis complete.

6. In infants, vomiting is one of the most frequent symptoms to mark the *onset of acute infectious diseases.* It is not quite so common in older children. It is most frequent at the onset of scarlet fever, pneumonia, and malaria. In these cases vomiting may be due simply to the arrest of digestion, or to the effects of the poison upon the nerve centres.

7. An accumulation in the blood of various *toxic* materials may provoke vomiting; the most frequent example is uræmia. In cyclic vomiting it is quite probable that the cause is the accumulation of some toxic agent in the blood. The absorption of ptomaines and other poisons taken in with milk or other food, or developed in the gastro-enteric tract, may excite vomiting. In some of these conditions it is possible that the vomiting may be eliminative—an effort on the part of Nature to get rid of the toxic materials. The cases dependent upon renal disease are discovered by frequent and careful examination of the urine. The other forms are often exceedingly obscure, and recognised only by the exclusion of all other frequent and infrequent causes of vomiting.

8. Vomiting may be *reflex* from irritation in the pharynx. This is frequent in young infants, who may induce vomiting by stuffing the fingers into the mouth. In certain cases the irritation from worms in the intestinal tract may cause vomiting, and it is possible that even dentition may produce it.

9. *Habit* is a frequent cause in cases of chronic vomiting. I have seen a child who had the power of vomiting at will anything in the nature of food which he did not like, yet whose stomach at the same time would bear large doses of quinine, to which he had no aversion, without the slightest disturbance. In young infants a habit of regurgitating the food may be acquired, so that this takes place more or less during the process of digestion after every meal. This is sometimes preceded by a movement of the mouth and fauces resembling swallowing, until finally the milk appears in the mouth. Habit is a potent cause in continuing vomiting where it has occurred frequently. In children who have this habit the most trivial cause will provoke it. It may be present without any other sign of gastric disease, and appears simply to depend upon exaggerated reflex irritability of the organ. These are exceedingly troublesome cases to control. Sometimes small quantities of food are better borne, and sometimes larger meals are retained when small ones are vomited. In some of these children gavage is the only means by which the vomiting can be controlled.

10. *Chronic vomiting* may depend upon habit, as just described, or

upon chronic indigestion, or it may be associated with chronic pulmonary disease; vomiting here being excited by the attacks of cough, at first only when the paroxysms are severe, and later even when they are slight. In chronic indigestion the vomited matters always are characteristic, they have a distinct relation to meals, and they are accompanied by other symptoms of deranged nutrition.

The diagnosis of a case in which vomiting is the chief symptom may be difficult. The first important distinction to be made is between cases in which the vomiting is of gastric origin, and those in which it depends upon other conditions, like intestinal obstruction, cerebral disease, toxic conditions, etc. It is only by a careful consideration of the other symptoms associated that an accurate diagnosis can be reached.

The treatment of vomiting is the treatment of the cause upon which it depends.

CYCLIC VOMITING.

This condition is one which has received but little attention. It is classed by some as a gastric neurosis. While at the present time we are not in a position to give it a definite pathology, it seems to be associated with a general derangement of nutrition which is in some way connected with formation and excretion of uric acid. It is not certain that all these cases have the same origin.

The disease is characterized by periodical attacks of vomiting, recurring at intervals of weeks or months without any adequate exciting cause. The vomiting is severe and uncontrollable, and usually lasts from twelve hours to three days. It is attended with symptoms of general prostration which may be alarming. The children who are subjects of it may show in the interval nearly all the signs of perfect health. The clinical picture presented by these cases is unique, and is well illustrated by the history of the following case, which is the most characteristic one that has come under my observation:

The patient was a well-nourished boy of six years when he first came under treatment. He belonged to a neurotic family, and the attacks dated back to infancy. From this time they had recurred usually at intervals of a few months; occasionally five or six months would pass without one. The symptoms in all the attacks were similar in kind, differing only in degree. I observed three of them. They were preceded by a prodromal period lasting from twelve to twenty-four hours, marked by languor, dulness, dark rings under the eyes, loss of appetite, and a general sense of discomfort in the epigastrium. At this time the temperature was generally but not always elevated, sometimes to 103° F. The vomiting then began suddenly. It was attended with great retching and distress; it was forcible, and often repeated every half hour or hour for two days. On one occasion it occurred seventeen times in a single night. Vomiting was immediately excited by the taking of any food or drink, but it occurred when nothing was taken. The vomited matters consisted of frothy mucus and serum, frequently streaked with blood, apparently from the violence of the emesis. The reaction was very strongly acid; sometimes there was bilious vomiting. The temperature usually fell to about 100° F. when the vomiting began, and continued at or below this point throughout the attack. By the end of the second day the exhaustion was very marked—so severe, in fact, as apparently to threaten life. The child lay in a semi-stupor, with eyes half open, lips and tongue dry, rousing at times to beg for water. The pulse was rapid and weak, and sometimes slightly irregular. There was no distention of the abdomen; it was usually flattened. By the third day the vomiting became less frequent and then ceased entirely. Convalescence was rapid, and by the end of the week the boy was as well as usual. After these attacks he was frequently better than for some time previously. Several other cases have come under my observation, all closely resembling this one, but, with two exceptions, the symptoms were not so severe. In one of these children the attacks lasted regularly five days.

A very similar case to the one whose history is given above, has been reported by Snow * (Buffalo). Gee † has published a series of nine cases of cyclic vomiting, two of which were of the type described, but much less severe.

Judging from these limited observations, cases may be seen at any period of childhood, and more frequently in girls than in boys. They are often seen in neurotic or gouty families. The general health and nutrition of the patients may appear excellent. The attacks are rarely traceable to the taking of indigestible food, and they have little in common with an ordinary severe attack of acute indigestion. Exhaustion or fatigue may bring on an attack, and one has been excited by some minor illness such as tonsillitis. The prodromal symptoms are lassitude, frequently headache, a sense of gastric discomfort, and very often fever, which, however, does not continue through the illness. In some of the cases, for some days before the attack, the stools are noticed to be almost white. Constipation is not marked, and is often absent. Severe epigastric pain is rare. The attacks seem to be self-limited, and they are but little affected by treatment.

Cyclic vomiting is certainly a nervous and not a gastric condition. It has many points of resemblance to an attack of migraine. The following observations made by Dr. C. A. Herter upon the urine of the case whose history I have given, strengthens this hypothesis, since the result is almost

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* Archives of Pædiatrics, 1893.

† St. Bartholomew's Hospital Reports, 1882.

identical with what is found in migraine. All the following observations were made upon the twenty-four-hours' urine:

TIME TAKEN.	Urea, grammes.	Uric acid, grammes.	Ratio of uric acid to urea.
Before the attack (normal)................	13·606	0·251	1 to 54
First day................................	17·249	0·110	1 to 157
Second day...............................	12·023	0·0912	1 to 132
Third day (convalescent).................	11·713	0·234	1 to 50
Several weeks after (normal).............	15·040	0·283	1 to 53

Observations made upon the urine in a second attack, three months later, gave results which were practically identical with the above. A second case of a somewhat similar type, but less severe, showed a ratio of uric acid to urea 1 to 83 during the vomiting, while in the same individual in health it was 1 to 42. Further observations are necessary before the full significance of these changes can be appreciated. The frequency with which the attacks are preceded by light gray stools, indicates that disturbance of the functions of the liver has a very close connection with the symptoms.

The prostration from the attacks is usually of short duration. The paroxysms are apt to recur unless a proper treatment of the case in the interval can be carried out. There seems but little tendency to spontaneous recovery. In most of the cases reported they have extended over a period of several years.

Diagnosis.—Organic disease of the brain and kidneys must first be excluded, the latter only by careful and repeated examination of the urine. The first attack witnessed may strongly suggest the onset of meningitis, but the course of the symptoms soon shows that this is not present. Usually a history of many previous attacks may be obtained. From acute indigestion, cyclic vomiting is differentiated by the fact that attacks are not brought on by indigestible food and also by the persistence of the vomiting. It is distinguished from gastritis by its severity, the shorter duration of its symptoms, and its self-limited course.

Treatment.—When the premonitory symptoms appear, free purgation by calomel offers the best prospect of aborting an attack. If the vomiting has once begun, nothing seems to have the slightest influence in controlling it. It is usually increased by the taking of food or drink or by any medication by the mouth, and all should be withheld. Ice may be held in the mouth to allay thirst. When the vomiting has ceased for several hours it is not likely to recur if food be very judiciously administered and in small quantities. Broth, whey, kumyss, or small quantities of iced milk and limewater in equal proportions may then be given. Acting upon the theory that the symptoms were analogous to those of migraine, the treatment I have adopted in the interval has been purely dietetic, consisting in the exclusion of all sugar and sweets, and in carefully limiting the amount of starchy foods. The diet prescribed has consisted of meat, green vegetables, milk, sour fruits, and stale bread. This diet has been followed in the case above reported, with the result that instead of having four or five attacks every year there had been at the last report but one attack in three years. In addition to careful regulation of the diet the general nutrition should be considered, and the patient's life so regulated that extreme fatigue and exhaustion should be prevented.

GASTRALGIA.

This term is applied to sudden, severe attacks of gastric pain. Gastralgia occurs as a symptom in most of the severe attacks of acute gastric indigestion; in such cases it is more marked in older children than in infancy. The pain of diaphragmatic pleurisy is often referred to the epigastrium, and may be so severe as to lead one to think that the stomach is the seat of disease. In vertebral caries of the dorsal region epigastric pain is a very frequent, early symptom. It is also common in children who suffer from malaria, at the onset of acute attacks, and it may be severe when the febrile symptoms are not well marked. In other cases pain in the stomach is of the nature of a true neuralgia, which may be excited by exposure to cold, by wetting the feet, by drinking ice-water, and by many other causes. Children who are predisposed to it often have attacks of considerable severity from comparatively slight causes.

In mild cases there is an intermittent pain, and usually no other symptoms. In severe cases the pain may be so great as to cause pallor, faintness, cold perspiration, and very marked prostration. When the origin of the pain is in the stomach the epigastrium may be hard and sometimes retracted, the stomach appearing to be in a state of spasm.

Treatment.—During the attacks the patient should be put to bed, and counter-irritation used over the stomach, best by means of a turpentine stupe or a mustard paste; sometimes a hot-water bag will suffice. Internally there should be given hot water containing brandy or gin and five drops of spirits of chloroform; all food should be withheld. Hot bottles should be applied to the feet if they are cold. In the interval between the attacks the treatment should be directed to the patient's general condition; especially should the cause be discovered. In cases of recurring pain of a neuralgic character the prolonged use of arsenic in the form of Fowler's solution, two or three drops three times a day, may prove of great benefit. In all cases attention should be directed to the diet, as in chronic indigestion.

ACUTE GASTRIC INDIGESTION.

This occurs whenever the stomach is unequal to the task imposed upon it. It may be either because the task is too great or because the capacity of the stomach for work is diminished. Under these two heads we may group the principal causes of acute indigestion.

Under the first head the most important thing is the giving of improper food. In infants this is most frequently the use of cow's milk which contains too much casein because not sufficiently diluted. Other common causes are sudden weaning or any other abrupt change in diet, the too early use of solid food, and overloading of the stomach. In older children the usual causes are the use of indigestible articles, such as unripe fruits, pastry, etc., overloading the stomach, and swallowing food without sufficiently masticating it. Conditions which may diminish for the time the capacity of the stomach for work are fatigue, depression induced by atmospheric heat, chilling of the surface, especially the extremities, dentition, and the nervous impression caused by the onset of any acute disease. The effect is seen both on the glandular and muscular apparatus of the stomach. The secretions are diminished or altered in character, and the motor activity of the organ is arrested.

Symptoms.—One of the first consequences of arrested gastric digestion is that the food remains long in the stomach. Instead of being empty in two or two and a half hours after feeding, as is normal in infancy, the food may remain in the stomach five or six hours, or even longer. The irritation from this undigested mass excites vomiting, which usually ceases after the stomach has been emptied. The vomiting may be preceded by nausea, pain, and constitutional depression which varies with the age and susceptibility of the child; in infants it may be very alarming.

It seems probable that, as a consequence of arrested gastric digestion, the proteids are not converted into peptones, but remain in the form of albumoses. These products have been shown by experiments on animals to be toxic, producing stupor and circulatory disturbances. They are diffusible and are undoubtedly absorbed with great rapidity, and may be the cause of nervous symptoms of a striking character. There may be dulness, stupor, and sometimes contracted pupils, so as to suggest opium narcosis, or there may be restlessness, excitement, and even convulsions. There is also marked prostration, weak pulse, and fever. The temperature in most cases of acute indigestion is from 100° to 102° F.; not infrequently it rises to 104° or 105° F. The tongue is coated and the appetite entirely lost. In infants these symptoms are usually associated with more or less evidence of intestinal disturbance—generally diarrhœa, with undigested food in the stools. Epigastric distention may be present. Usually the vomiting ceases in from six to twelve hours, and after the stomach has been thoroughly emptied the temperature falls. Provided rest to the organ can be secured, and the exciting cause is one that can be removed, the patient may be quite well in two or three days. Relapses are, however, easily excited. It is surprising to see in a susceptible patient how trivial a cause may excite a relapse.

The diagnosis between a simple attack of acute indigestion and one of gastritis can not be made at the outset. The former is much more frequent, and may be quite as severe, but is of shorter duration. The continuance of the severe symptoms, especially pain, thirst, fever, and vomiting of mucus tinged with blood, justify the inference that inflammatory changes exist. The prognosis in these cases is good, except in very young or very delicate infants. In such patients an attack of acute indigestion is not infrequently fatal.

Treatment.—The indications are, to empty the stomach as completely as possible and then to secure to it absolute rest. If proper treatment is employed at the outset, the majority of such attacks can be cut short. Nothing is so efficient in infants as stomach-washing. (See page 60). A single washing usually suffices. If for any reason this can not be employed, the child may take from its bottle a large amount of lukewarm water. The free vomiting which this usually produces may be sufficient to cleanse the stomach fairly well, but by no means so easily as stomach-washing. Persistent vomiting is sometimes arrested by giving small quantities of quite hot water.

The subsequent treatment is chiefly dietetic. Nothing whatever is to be given for three or four hours, and then albumin water* or ice-cold whey (page 152), frequently, and in small quantities—e. g., half an ounce to one ounce every hour. After twenty-four hours barley water, raw beef juice or broth may be tried, but no milk for at least three days. When begun, it should be peptonized and diluted with five or six parts of water. In a nursing child, the breast should be withheld altogether for twenty-four hours, and then nursing allowed for two minutes every three hours, the time of nursing being gradually increased to three, five, and ten minutes as improvement occurs. The great mistake made in these cases is to begin food too early and to give too much, especially of cow's milk.

Drugs are relatively of little value. If the measures mentioned have been used promptly they will not often be required. In many cases injudicious medication aggravates the symptoms and prolongs the attack. Unless the bowels have acted freely, calomel (gr. $\frac{1}{10}$ every hour) may be given until this effect is obtained. Where there is continuous vomiting of very acid mucus and serum, alkalies are indicated—limewater, chalk mixture, or the subcarbonate of bismuth. It is important to keep the child as quiet as possible. Local applications to the epigastrium are very often useful. Either dry heat may be applied by means of a hot-water bag or hot flannels, or more active counter-irritation by mustard. In older children the stomach is to be emptied by an emetic, such as ipecac, accompanied by large draughts of warm water. After this it should be kept entirely at rest for half a day, only carbonated waters or barley water being allowed in small quantities to allay thirst. Later, broth or beef juice may be given, then milk diluted with two parts of limewater. The patient should be kept upon a very low diet for four or five days.

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* *Albumin-water:* The white of one fresh egg, one half pint cold water, previously boiled, a little salt, one teaspoonful of brandy; shake thoroughly, and feed cold.

ACUTE GASTRITIS.

In comparison with the frequency of inflammatory diseases of the intestine, those of the stomach are rare, particularly so in infancy. Gastritis seldom exists alone, but is usually associated with enteritis or colitis.

Etiology.—The causes of gastritis are, in the main, those of acute gastric indigestion—improper food or feeding. Besides, it may be caused by the introduction of irritants, which may either be accidentally swallowed or given as drugs. The mucous membrane of the stomach has much more resistance to infection than has that of the intestines; but in certain forms of inflammation, especially the membranous, infection is clearly the cause.

Lesions.—The mucous membrane of the stomach may be the seat of acute catarrhal, follicular, or membranous inflammation, all forms except the catarrhal being very rare. There is also seen a mixed form, from its cause usually designated as "corrosive" gastritis.

Catarrhal gastritis.—This is characterized by hyperæmia of the mucous membrane, exudation of cells into the mucosa, a great increase in the secretion of the mucous glands, and changes in the epithelium. About the only change which can be recognised by the naked eye is congestion and swelling of the mucous membrane. These are usually more marked toward the pyloric end and along the greater curvature. There may be small extravasations of blood into the mucosa. The stomach contains undigested food and mucus, which may be thick and tenacious, adhering very closely to the mucous membrane. The mucus may be stained brown from the capillary hæmorrhages. The stomach may be either distended or contracted. Under the microscope the changes are seen to be almost entirely in the mucosa. In places there is loss of the superficial epithelium, in others only degenerative changes in it are seen. The mucosa is infiltrated with round cells, this process being rarely diffuse, but generally occurring in patches. The blood-vessels are distended and many small extravasations are seen. Sometimes there is a moderate infiltration of the submucosa. Acute catarrhal gastritis alone is rarely severe enough to cause death. It is usually seen in cases which prove fatal from other causes, particularly diseases of the intestine.

Gastric softening (*gastromalacia*) is a condition dependent upon post-mortem changes—probably self-digestion of the stomach. It is found both where gastric symptoms have been present and where they were absent. It is situated nearly always in the posterior wall, and usually covers a considerable area, about one third or one fourth of this wall. It is recognised by the gelatinous, translucent appearance of the walls of the stomach, which are so softened that the finger may be pushed through them without force, sometimes so that the stomach ruptures while it is being removed. This condition is rarely seen when the stomach is empty. It can scarcely be mistaken for a pathological condition, if its occurrence is borne in mind.

Follicular gastritis.—This is usually seen in connection with catarrhal inflammation, but it may form the most important feature of the lesion. The cases are quite rare. I have met with one marked example in an infant three weeks old. The others I have seen were associated with ileo-colitis. The characteristic feature is inflammation of the solitary lymph nodules of the stomach, which, like those in the colon, undergo swelling, softening, and ulceration. The lesion can not be recognised by the naked eye, unless ulcers are present. These appear rather thinly scattered over the mucous membrane of the stomach, about a line in diameter. They are seldom closely set as in the intestine. Large follicular ulcers I have never seen. Under the microscope the ulcers are seen to be in all respects similar to those found in the colon, except that they are smaller and more superficially situated, generally being entirely in the mucosa.

Membranous gastritis.—This is even more rare than the varieties previously mentioned. I have met with it but four times. One case was associated with a membranous colitis; a second case with pseudo-diphtheria of the fauces and larynx in an infant but six weeks old. The œsophagus was not involved in this case; and indeed it often escapes. No Loeffler bacilli could be found either in cover-slip preparations or by culture. Both these cases have been very fully reported by Dr. Martha Wollstein.* To the naked eye the membrane appears as of a grayish-green colour; it is adherent, but can be detached in quite large patches. Only a portion of the stomach was covered in any of the cases; in two the principal disease was about the pylorus; in another along the greater curvature. In Fenwick's case the entire surface of the stomach was lined with membrane. The microscopical appearances resemble those of membranous colitis. There is a pseudo-membrane composed of fibrin, granular matter, epithelial cells, and bacteria. The mucosa shows a moderately dense infiltration with round cells, and in places superficial ulceration. There is also infiltration of the submucosa, and in some places even the muscular coat is involved.

Membranous gastritis occurring in patients dying of diphtheria has been described by Smirnow, Andral, Rilliet and Barthez, Cahn, Fenwick, and others, but I have not been able to find any case in which the diagnosis of true diphtheria of the stomach was confirmed by cultures.

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* Archives of Pædiatrics, July, 1892. Here will be found an excellent summary of the literature of membranous gastritis.

Corrosive gastritis (*toxic gastritis*).—This form of inflammation is excited by various irritating and caustic substances, which are usually taken by accident, sometimes for the purpose of producing emesis. The most frequent substances are carbolic acid, caustic alkalies, mineral acids, arsenic, salts of copper, zinc, or antimony, croton oil, and corrosive sublimate.

The lesions in the stomach depend upon the amount of the substance swallowed, the degree of concentration, and whether the stomach was full or empty at the time. Strong caustics, whether acids or alkalies, usually act more deeply and extensively in the pharynx and œsophagus, for, owing to the spasmodic contraction of the muscles of these parts, often but a small amount of the substance reaches the stomach. Concentrated irritant poisons produce in the stomach irregular ulcers, especially along the greater curvature, which may be so deep as to cause perforation, or they may affect the mucous membrane only. In severe cases death takes place early, often in a few hours. Dark, ragged ulcers are found in the stomach, the surrounding mucous membrane is the seat of intense congestion, and in places there are extravasations of blood. If death is later there are evidences of intense inflammation, sometimes with the production of pseudo-membrane. If the amount of poison is not sufficient to cause death, and if the patient recovers from the consecutive gastritis, a cicatricial condition of the stomach results, which may later lead to stenosis of the pylorus or other deformity of the organ.

Symptoms.—*Catarrhal gastritis* can not be distinguished in its beginning from an attack of acute indigestion. There are fever, pain, vomiting, thirst, loss of appetite, coated tongue, and prostration. The presence of inflammatory changes is indicated by the continuance of these symptoms, particularly the pain, vomiting, fever, and thirst. With the pain there may be epigastric tenderness. All food or liquids are immediately rejected, and even when nothing is taken the retching and vomiting may continue, nothing but frothy mucus or serum being brought up, sometimes streaked with blood. The vomited matters are usually very sour; they may be bilious. The temperature is high only at the outset. After the first or second day it usually ranges between 100° and 101·5° F. Thirst is intense, and all liquids are taken with avidity, especially if cold, even though they are immediately vomited. The tongue is thickly coated with a white fur, and the breath may be foul. The constitutional symptoms are generally most severe at the outset. The usual duration of such attacks is four to seven days, but with improper management, especially injudicious feeding, the disease may be much prolonged. One attack may follow another until a chronic condition is established. In most of the cases there is some disturbance of the intestines, usually a sharp attack of diarrhœa. Sometimes the gastric symptoms subside after a few days and those of the intestine become the predominant ones. The symptoms above given are those of infancy. In older children there is less of fever, prostration, and diarrhœa, but pain and vomiting are prominent. The attacks are usually shorter and altogether less severe.

The rare cases of *follicular gastritis* have nothing by which they can be distinguished from the form described, except a more prolonged course and a greater liability to hæmorrhage, blood sometimes being vomited in quite large amounts.

Membranous gastritis also presents no peculiar symptoms. In fact, in the cases I have personally seen, the gastric symptoms were insignificant, and the condition not suspected during life.

In *corrosive gastritis* the effects of the caustic may be seen in the mouth and pharynx, the mucous membrane being of a gray or whitish colour. There are felt pain and a sense of constriction in the œsophagus and stomach, with great thirst. Vomiting follows almost immediately, and the matters vomited are usually bloody. The subsequent course in most of the cases is the rapid development of collapse, and death in a few hours from shock. The younger the child the sooner does the case terminate. In irritant poisoning not severe enough to produce death, the symptoms of acute gastritis follow, usually accompanied by more or less enteritis owing to the passage of the irritant into the intestine. There is seen a continuance of the vomiting, pain and epigastric distention, and diarrhœa, and from these symptoms death may result in two or three days. It is extremely rare in infancy for the patient to survive both the stage of shock and that of acute inflammation, so that the deformities of the stomach and the chronic conditions mentioned, are practically never met with excepting in older children.

Treatment.—Cases of acute catarrhal gastritis are to be managed very much like those of acute gastric indigestion. Thirst may be relieved by swallowing bits of ice. Where there is continuous vomiting of acid mucus, relief is sometimes afforded by repeating the stomach-washing once in twelve hours with a 1-per-cent solution of bicarbonate of soda, used at 110° F. In older children, beneficial results sometimes follow the use of bismuth subcarbonate (gr. x every two hours); but in infants I must confess to have seen but little effect from any form of medication, the reliance being upon rest, careful feeding, and stomach-washing.

Cases of corrosive gastritis require special treatment. The first indication is to administer the proper chemical antidote to the substance swallowed, and the next to use bland mucilaginous or oily fluids, such as milk, albumin-water, oils in large quantities, etc. Especially should stomach-washing be avoided. Opium is always required, on account of pain, and should be given hypodermically. The general symptoms are to be treated according to the indications of the individual case.

GASTRO-DUODENITIS.

This is a catarrhal inflammation of the stomach and duodenum. Sometimes only the duodenum is involved. The inflammation commonly extends from the intestine to the common bile duct, the swelling of which causes jaundice. The term gastro-duodenitis is sometimes used synonymously with catarrhal jaundice. The condition is a rare one in young children, and especially so in infancy. I have never seen it in a child under two years.

The causes are for the most part obscure. It occasionally complicates malarial fever. I have twice seen it with influenza, and it may occur with any of the infectious diseases. Rehn has described a form which occurred epidemically.

The symptoms of the disease are quite uniform. When primary, the onset is like an ordinary attack of indigestion, with vomiting, pain, slight fever, and a moderate amount of prostration. The vomiting in some of the cases is repeated for several days. The pain may be quite severe, and localized in the region of the duodenum. It may be associated with tenderness in this region. The bowels are usually constipated. After three or four days, icterus, which is the only diagnostic symptom, appears. It is first seen in the conjunctiva, afterward in the skin, varying in degree according to the severity of the attack, but in most cases not being very intense. It is accompanied by the regular symptoms of obstructive jaundice. The stools are gray, sometimes white; there is a marked amount of intestinal flatulence. The urine is very dark, of a yellowish-green or bronze hue, and stains the clothing. There is complete anorexia; the tongue is thickly coated with a white fur. There are headache, dulness, and languor, and the patient feels generally wretched. The slow pulse and the itching skin are uncommon symptoms in children. The liver is usually found, upon examination, slightly enlarged, and sometimes tender on pressure. The duration of the disease is about two weeks, the general symptoms disappearing before the icterus.

The diagnosis rarely presents any difficulty, and the prognosis is invariably good.

Treatment.—In the diet, fats and starches should be reduced to a low point or be entirely prohibited. Patients usually do much better upon a diet of rare meat, fruit, and a moderate amount of milk. If there is very much vomiting, the milk should be largely diluted with limewater or partially peptonized. The amount of food given should be small, but water should be allowed freely, particularly the mineral waters. The bowels should be opened every other day by calomel, followed by a saline purgative. In most of the cases no other treatment is necessary. When the pain is severe it may be relieved by counter-irritation by mustard, turpentine, or even cantharides. The gastric symptoms should be managed like those of ordinary acute gastritis. The restricted diet should in all cases be continued for at least a week after the jaundice has disappeared.

CHRONIC GASTRIC INDIGESTION—CHRONIC GASTRITIS—GASTRIC CATARRH.

Although from a pathological point of view these conditions are not identical, from a clinical standpoint there is no advantage in attempting to separate them. Nothing distinguishes chronic indigestion from chronic gastritis except that in the latter, in addition to continued derangement of function, there is a great increase in the production of gastric mucus. Chronic indigestion seldom exists long without the production of a slight amount of catarrhal inflammation. This is usually of a very low grade. This condition in the stomach seldom, if ever, exists without more or less involvement of the intestine, and in the majority of cases the intestinal condition is the more important. In some, however, the gastric symptoms predominate, and it is only those which are here considered.

Etiology.—Chronic gastric indigestion may follow acute attacks, or it may be chronic from the outset. If the latter, it depends in infancy upon the continued use of improper food or bad habits of feeding. It also complicates most of the constitutional diseases of infancy, especially rickets, syphilis, tuberculosis, malnutrition, and marasmus. It may follow any of the acute infectious diseases. In older children it is chiefly due to the use of improper food, sometimes to the habit of rapid eating and insufficient mastication. It is associated with constitutional diseases as in infancy, and may complicate valvular disease of the heart.

Lesions.—The changes found in chronic gastritis are usually confined to the mucosa. In the mild form there are degenerative changes of the epithelium of the tubules, with increased production of mucus; there may be a slight infiltration of the mucosa with round cells. The more severe form, with marked cell infiltration and the production of new connective tissue, is extremely rare. The submucous coat may be thickened and the muscular coat attenuated. The lesion can not be recognised by the naked eye. The stomach is apt to appear more or less dilated, and its surface is coated with thick and very adherent mucus. This lesion rarely exists alone, practically never in infancy, but is associated with similar lesions in the intestines, the latter being more severe.

Symptoms.—*In infants.*—For our knowledge of the conditions existing in the stomach in chronic indigestion we are indebted to the work chiefly of Cassel, Leo, Troitzky, and Wohlmann. There is in most cases an excessive production of mucus which is tough and adherent, and may interfere with digestion, even though secretions are normal. Mucus is especially abundant in young infants. The reaction of the stomach is almost invariably acid. The rennet ferment is always present. Pepsin is found in nearly all if not in all the cases. Hydrochloric acid is generally very scanty; but is increased by irrigating the stomach. Fermentation takes place, particularly in the fats and in the gastric mucus. The results of fermentation are the production of lactic, acetic, butyric and other volatile fatty acids. New products are also formed from the decomposition of albumin, and gases are always present. Food remains long in the stomach because of motor inactivity, which is partly the cause and partly the result of the disease. It often continues after all other symptoms have disappeared.

The most constant symptom is vomiting. This is rarely absent, and it may take place at any time after feeding. Some infants vomit regularly within half an hour or an hour after feeding, some only occasionally and at longer intervals. The vomited matters consist of food, often that which has been given six or eight hours before, and mucus, which may be in large quantities, as much as an ounce at a time. The food remains long in the stomach. This is best ascertained by stomach-washing. Instead of being empty in two or three hours, as the stomach should be, food is almost invariably found four or five hours, and in some cases six or eight hours, after feeding. This is one of the most constant and conclusive signs of gastric indigestion.

Undigested food, especially casein, appears in the stools. The appetite may be good or it may be very poor. As a rule, children take less food than in health. The tongue is usually coated; there are signs of general malnutrition; there are seen fretfulness and irregular or disturbed sleep; most children cry a great deal, but some are unnaturally quiet; the weight is stationary, or there is steady loss; there is also anæmia, and the child's development is arrested. There is always some derangement of the bowels, occasionally constipation with the constant presence of masses of undigested food in the stools, but more frequently there is diarrhœa. There may be dilatation of the stomach. This is especially liable to occur in rachitic children where overfeeding has long been practised.

The course of these symptoms is indefinite. There is little tendency to spontaneous recovery, and they often go on for several months, until some intercurrent disease develops which proves fatal.

The prognosis depends upon the age of the patient, the duration of the disease, the surroundings, and upon how well treatment can be carried out. In infants under three months the prognosis as to life is often bad. If children live to the age of seven or eight months, they may recover with proper treatment. These patients do much better in private practice than in institutions. Much depends upon the co-operation of an intelligent mother or nurse. Chronic gastric indigestion is not dangerous to life except in very young infants. Its principal danger consists in the predisposition it gives to acute diarrhœal diseases in summer. Such patients are almost certain to be attacked, and are very likely to succumb. It may also lead to the development of marasmus. Chronic indigestion increases very much the danger from all acute diseases.

In older children.—In all cases the most constant symptom is vomiting, which may occur regularly after meals, or only in the morning before breakfast. If the latter, the vomited matters consist chiefly of mucus. In addition to these regular attacks there may be the frequent regurgitation of small quantities of food. There are gastric flatulence and pain, due to hyperacidity or to acid fermentation. The appetite is variable—sometimes inordinate, sometimes entirely lost; it may be capricious, there being usually a craving for highly seasoned food. The tongue is constantly furred, and the breath usually disagreeable. These symptoms are seen in all degrees of severity. Intestinal disturbances are not so frequent as in infancy. Constipation is more common than diarrhœa. The general symptoms are those of malnutrition. There are anæmia, wasting, constant fretfulness, disturbed sleep, and various other nervous disorders. These symptoms, as in the case of infants, may continue indefinitely; there is little tendency to spontaneous recovery, but under favourable circumstances, with constant care, much may be done for all these patients and many of them may be completely cured.

Treatment.—*Infants.*—The general treatment is too apt to be ignored, but it is just as important as measures directed more specifically to the stomach. A large, roomy nursery, and plenty of fresh air by night and by day, are very important; sometimes under the influence of these alone improvement begins. General friction of the body with cocoa-butter is useful in delicate children with poor circulation. Infants must be properly covered, and it is of the utmost importance that the feet be kept warm. Of the measures directed to the stomach, only two are to be depended upon—stomach-washing and diet.

Stomach-washing (page 60) is useful, first, in removing the mucus which is so abundant in most of these cases; secondly, in cleansing the organ thoroughly at least once a day, this of itself is a most important result; thirdly, as a stimulant to the gastric secretions, especially hydrochloric acid. Plain boiled water, or a weak alkaline solution—sodium bicarbonate, one drachm to the pint—may be employed. In the early part of the treatment the washing should be done daily; later, every second or third day. The time selected is not very important, but it is better to make this about three hours after feeding. The mother or nurse may easily be taught to wash the stomach, so that it may be done as frequently and for as long a period as circumstances require.

In the matter of diet, the general purpose should be to give the stomach as little to do as possible, throwing for the time the burden of the work of digestion upon the intestine. As the greatest difficulty is in the digestion of casein, it is usually better, in the case of a young infant—i. e., one under six months—to secure a wet-nurse. But this may not succeed as well as artificial feeding, as it is in our power to modify the food only to a limited extent. Where a good wet-nurse can not be obtained, or where even breast milk is not tolerated, cow's milk should be tried. In modifying cow's milk, it should not be forgotten that the fat as well as the casein may be a source of trouble. With the milk sugar there is usually no difficulty. The best results are obtained by beginning with such formulæ as XVII or XVIII (page 176), obtained by diluting plain milk with a sugar solution. In these, both the proteids and fat are very low and the sugar relatively high. The proportions of the first two ingredients may be gradually increased as the case improves. If this plan fails, the milk may be completely peptonized (page 148) before it is diluted. Partially peptonizing is frequently no better than the above modification used alone. In very obstinate cases whey (page 152) may be tried, and may be retained when even the small proportion of fat and casein in the formulæ mentioned, causes disturbance. Often where no casein can be tolerated, raw beef juice or some of the beef peptones, such as Mosquera's beef jelly, are assimilated without difficulty, and may be used exclusively for days at a time. In infants over six months old some farinaceous food, such as a thin gruel of barley or arrowroot, may be given alternately with the beef preparations; or one of the malted foods may be used in the same way. Other suggestions regarding diet will be found in the chapter on Feeding of Difficult Cases during the First Year (page 180).

The quantity of food given at one time and the frequency of feeding are also important. Under no circumstances should an infant with chronic indigestion be fed oftener than once in three hours, and in many cases the interval for children over three months of age should be four hours. The bottle should always be taken away in twenty minutes after the meal has begun. The number of meals in a day should be the same as for healthy infants. The amount of food should always be rather less than that required by a healthy infant of the same age. It is wise to begin with about half the quantity, gradually increasing as the child's powers of digestion improve. Gavage is sometimes useful where vomiting is frequent and can not be controlled. Food administered in this way may be retained, when it is immediately vomited if given from the bottle or the spoon.

Drugs have a very limited application in these cases. Usually they are too much employed. The majority of patients do better when they are withheld entirely. They may be useful for particular symptoms. Alkalies may temporarily relieve cases with excessive acid fermentation. Small doses of strychnine or nux vomica may stimulate the motor activity of the muscular walls of the stomach. Hydrochloric acid at times may decidedly improve the digestion where it is given well diluted after meals; often, however, it causes vomiting. Almost all the indications mentioned are more promptly and efficiently met by stomach-washing than by the other means referred to.

The management of these cases in older children must be conducted along the lines laid down for infants. In them, stomach-washing can not be employed, and other means must be used to clear the stomach of mucus. The best is undoubtedly the use of large draughts of water, as hot as can be borne, an hour before eating. From six to eight ounces should be taken, preferably slowly by sipping. To this may be advantageously added, in many cases, fifteen or twenty grains of bicarbonate of soda.

The diet should consist of milk diluted at least three times, kumyss or matzoon, beef juice, raw meat, beef peptones, and a moderate amount of starchy food, preferably dried bread or zwieback. Sweet fruits, and in many cases all fruits, must be avoided. The amount of water taken at mealtime should be carefully restricted. Beneficial results are obtained in most of these cases by the use of nux vomica or simple bitters before meals, and the regular administration of hydrochloric acid (gtt. v to viii of the dilute acid) shortly after meals. All pastry, sweets, nuts, and candies must be absolutely prohibited. With improvement in the symptoms green vegetables may be added to the diet, and the amount of starchy food increased. The general treatment must not be neglected. The patient should lead an out-of-door life as much as possible, and regular but very moderate exercise allowed. Great caution is necessary against overfatigue. Iron may be given in most cases during convalescence; but cod-liver oil should be carefully avoided until the gastric symptoms have quite disappeared. Relapses are easily excited, and the most constant care regarding the food must be maintained for months, or even years.

DILATATION OF THE STOMACH.

Moderate dilatation of the stomach is quite a frequent condition, although it is not so large a factor in the disorders of digestion in infancy and childhood, as many who have written upon the subject would lead us to believe. A very marked degree of dilatation is rare, but in these cases its recognition is important and its treatment difficult.

Dilatation is almost invariably regular or cylindrical; it is usually most marked at the cardiac extremity (Fig. 48). Cases of irregular or saccular dilatation, except when associated with cicatricial conditions, are of somewhat doubtful occurrence. The irregular shapes of the stomach found at autopsy, dependent upon the contraction of the muscular coats, may be easily mistaken for hour-glass contraction or saccular dilatation. The degree of dilatation may be very great; thus, the stomach of a child three months old measured at autopsy nine ounces; another, four and a half months old, ten ounces; and in one extreme case, the stomach of a two-weeks old baby was dilated to the capacity of seventeen ounces. The greatest dilatation I have measured during life was in a child four months old, where the stomach held twelve ounces.

In very rare instances dilatation may result from congenital stenosis of the pylorus. The most important predisposing cause, however, is the muscular atony which accompanies rickets. It is found to a slight degree in almost all severe cases of rickets. The principal exciting causes are continued distention from overfeeding and chronic indigestion.

In most cases the only symptoms are those of the chronic indigestion which almost invariably accompanies dilatation. If there is pyloric stenosis, vomiting is present. In young infants the pressure symptoms may be very serious. This is particularly true in infants with acute bronchitis or broncho-pneumonia, or in those with atelectasis. In these patients I have seen very grave symptoms accompany the rapid distention of a dilated stomach, and in one very delicate infant of three months this was apparently the cause of death. A positive diagnosis of dilatation is only made by the physical signs. There are epigastric fulness and distention, and in some very thin patients the outline of the stomach can be distinctly seen. Dilatation of the transverse colon, however, may be mistaken for dilatation of the stomach. In the latter, the lower outline is convex, while in the former it is usually slightly concave. The most satisfactory means of diagnosis is by percussion. The examination should be made three or four hours after feeding, at which time the whole abdomen is apt to be tympanitic. The stomach should then be filled with water; the lower limit of the area of flatness will be the lower border of the stomach. This is much more satisfactory than determining the outline after the generation of gas in the stomach. If the lower border comes nearly to the umbilicus the stomach is dilated; if it is below the umbilicus, it is much dilated. In many cases the capacity of the stomach can be measured by simply seeing how much water can be easily introduced into it by means of the funnel and stomach tube.

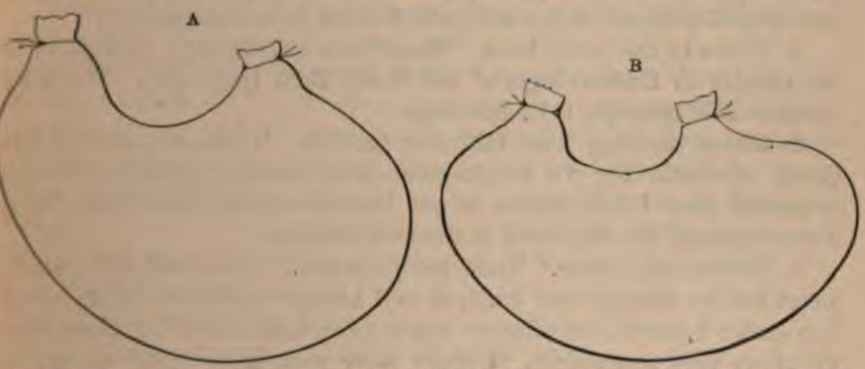

FIG. 48.—A, dilated stomach from rachitic child of six months; B, stomach of healthy child of same age. (Outlines reduced from photographs.)

The prognosis in dilatation of the stomach is good except when it is due to pyloric stenosis. If the infant has any acute or chronic pulmonary disease, dilatation of the stomach may add to the discomfort and even the danger from that condition.

In the management of these cases the first point is to reduce the size of the meals, and to regulate the diet in accordance with the general plan outlined in the chapter on Chronic Indigestion. If the dilatation is marked, the stomach should be washed once a day. The general condition of the patient usually requires tonics, the best of which is strychnine; and rickets, if present, should receive its appropriate constitutional treatment.

ULCER OF THE STOMACH.

Ulceration of the stomach may be found in connection with several pathological processes which are quite distinct from one another:

1. Ulcers in the newly born. These have already been referred to in the chapter on Hæmorrhages of the Newly Born (page 101). The only characteristic symptom is hæmorrhage.

2. Ulcers resulting from follicular gastritis. These also are not frequent. As a rule they give no symptom except those of gastritis, although in several cases I have known severe hæmorrhage to result from them. These cases will be considered in the next chapter.

3. Tuberculous ulcers. These are quite rare. I have met with gastric ulcers but five times in one hundred and nineteen autopsies on tuberculous cases; however, the evidence was not conclusive in all of them that the ulcers were tuberculous. Usually there were many small ulcers; in one case but two were present, the larger one being nearly three fourths of an inch in diameter, and situated on the posterior wall near the middle of the greater curvature. All but one of these cases were in infants, one child being only ten months old. The ulcers gave no symptoms during life, and death took place from general tuberculosis. This is the history of nearly all the few cases on record. In one, however, reported by Casin, a tuberculous ulcer perforated the stomach and caused death from peritonitis. Active symptoms—bloody vomiting and bloody stools—were excited by the use of an emetic.

4. Round perforating ulcers. These are in their pathology essentially the same as similar ulcers in the adult. I have found but three cases on record in non-tuberculous patients. Two were in young children. Reimer's* case, three and a half years old, had bloody vomiting and stools for several days before death took place as a result of perforation. Colgan† has recently added another case in a child two and a half years old, where no symptoms were present until twelve hours before death,

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* Jahrb. für Kinderh., x, p. 289.

† Medical News, Philadelphia, October, 1892.

when perforation occurred. The characteristic symptoms of ulcer before perforation, are gastric pain and tenderness, vomiting of blood, and often bloody stools. Perforation is accompanied by collapse, sometimes by high temperature, the rapid development of tympanites, and death from shock or from peritonitis.

The prognosis is bad in all forms of ulcer of the stomach, except the small follicular variety. In this, however, the diagnosis can not positively be made excepting by gastric hæmorrhage, and it is only this which makes these cases serious.

Treatment.—The treatment is absolute rest, ice, small doses of opium, rectal feeding, stimulants; later, bismuth, arsenic, or nitrate of silver.

HÆMORRHAGE FROM THE STOMACH (HÆMATEMESIS).

The most frequent variety of hæmorrhage from the stomach, that met with in the newly born, has already been considered. (See page 103.)

I have met with three fatal cases in young infants, the eldest being fifteen months old. In the first case there were symptoms of ordinary gastro-enteritis. On the seventh day the vomiting of blood began, and was repeated about ten or twelve times during the next twenty-four hours, when death took place. The blood was quite abundant, as much as a drachm of red blood being discharged at once. At autopsy there were found in the stomach about two ounces of dark-brown fluid, but no gross lesion was discovered, and no explanation of the bleeding. This hæmorrhage was apparently capillary. In the second case there were symptoms of acute gastro-enteritis of thirty-six hours' duration. After this time there was marked abdominal distention with symptoms of collapse; then a profuse hæmorrhage from the stomach, the child dying while vomiting blood. At least half a pint was discharged. The stomach contained at autopsy two ounces of dark fluid blood, and the mucous membrane was filled with minute ulcers extending quite through the mucosa. In the third case there was no vomiting of blood, but the patient died with symptoms of internal hæmorrhage. There was blood in the upper part of the intestine, and the stomach was filled with blood; it contained many small follicular ulcers resembling those found in the previous case.

Hæmorrhage from the stomach may occur in purpura, hæmophilia, scurvy, and rarely in malaria. In young girls about puberty it may be a form of vicarious menstruation. Occasionally blood may be vomited in cases of hæmorrhagic measles. Two cases are reported in which fatal hæmorrhage followed the swallowing of a foreign body. In both, vomiting of blood occurred long after the original accident. In one case two and a half years had elapsed. The autopsy in this case showed impaction of the foreign body and ulceration into the arch of the aorta. Spurious hæmorrhages may occur where blood has been swallowed and then vomited. The source of this is most frequently the nose or pharynx. It may happen in infants at the breast, where the blood is drawn during nursing from a fissure or ulcer in the nipple. The amount of blood vomited under these circumstances may be large enough to be quite alarming. It may be recognised by the child's general condition being normal, and by the presence of fissures or ulcers upon the nipple. It may sometimes be noticed that the vomiting of blood follows nursing from one breast and not from the other.

Symptoms.—There may be no symptoms except those of internal hæmorrhage, but this is rare. Usually there is vomiting of blood, and blood appears in the stools. If the hæmorrhage is rapid and vomiting speedily occurs, the blood may be of a bright-red colour. If it has been long in the stomach it is of a dark-brown or black colour resembling coffee-grounds. The stools containing blood from the stomach are black and tarry in appearance. The general symptoms will depend upon the amount of blood lost.

In a case where blood is vomited, the first point is to distinguish spurious from true gastric hæmorrhage. The nose and pharynx, especially its posterior wall, must be carefully examined. If the child is at the breast, the nipples should be scrutinized. In older children it is important to distinguish vomiting of blood from hæmoptysis. This distinction is to be made in accordance with the rules laid down in text-books on adult medicine. The prognosis is bad if the hæmorrhage is due to ulcer, if it is very profuse, or if it occurs in young infants. When it occurs in connection with constitutional diseases the prognosis depends upon the original disease.

Treatment.—The patient should be kept quiet, preferably upon the back, and Monsel's solution administered in small doses, largely diluted. Should the patient show signs of collapse, stimulants may be given hypodermically or by the rectum. No food should be given by the stomach until some time after the hæmorrhage has ceased.

CHAPTER VI.

DISEASES OF THE INTESTINES.

MALFORMATIONS AND MALPOSITIONS.

MALFORMATIONS are not very frequent, but are of great variety. With the exception of those situated at the lower end of the intestine they are not of much practical importance, for the condition is such ordinarily as to be incompatible with life. They may be met with at any point in the canal, but most frequently they are in the rectum and anus. Aside from these, malformations of the large intestine are much less common than those of the small intestine.

Malformations of the Rectum.—In Fig. 49 are shown the usual varieties of malformation of the rectum. The most frequent is atresia ani (1). In this the cutaneous septum has not been absorbed, but the intestine is normal to its lower extremity. This form is readily curable by a surgical operation. In the next variety (2) the cutaneous orifice and the lower part of the rectum are normal, but a membrane separates this portion from the upper part of the gut. This is usually situated within two or three inches of the anus. The bulging of the lower part of the distended intestine can usually be felt by the finger in the rectum, and a simple division of the membrane by a guarded bistoury may relieve the condition. The third form (3) is more serious. Here the rectum terminates in a blind pouch at a variable distance from the anus, and is represented below by an impervious fibrous cord. The diagnosis of this condition can not positively be made without opening the abdominal cavity. The bulging of the intestine appreciable by the finger in the rectum, is the only point which differentiates the preceding variety from this one. Instead of atresia of the rectum there may be stenosis of varying degrees, which may give rise to the usual symptoms of stricture. This is often curable by dilatation.

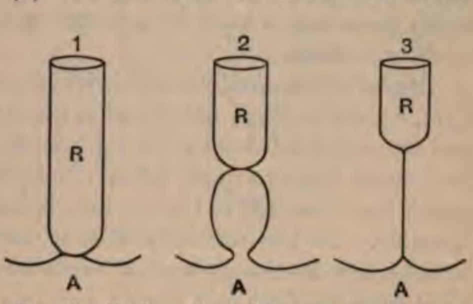

FIG. 49.—Malformations of the rectum. A, anus; R, rectum.

Malformations of the Small Intestine.—There may be stenosis or atresia at any point, often at many points. Obstruction is much more frequently in the upper than in the lower part of the small intestine, the most common seat being the duodenum. Atresia is more often seen than stenosis. There may be a single point of obstruction, or the lumen of the intestine may be obliterated for a considerable distance, the intestine being represented only by a fibrous cord which connects the two open portions, or there may be no connection between them. In all cases the intestine above is found very greatly distended, and that below empty and usually atrophied. The causes of these multiple deformities are mainly two—fœtal peritonitis and volvulus.* In fœtal peritonitis there are usually found bands of adhesions between the intestinal coils, and between the intestine and the solid viscera. Syphilis has been assigned as a cause in many cases. Volvulus, or a twisting of the intestine during its development, is a more satisfactory explanation for the majority of the cases, especially where there are multiple points of atresia. All these conditions are beyond the reach of surgical treatment. The symptoms appear soon after birth and are those of intestinal obstruction. (See page 115.) The higher the point of obstruction the shorter the duration of life; it is rarely more than a week in any case of atresia; in stenosis it may be two or three months.

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* Silbermann (Jahrb. für Kinderh., Bd. xviii, p. 420) makes peritonitis the principal cause, while Gaertner (Jahrb. für Kinderh., Bd. xx, p. 403) attributes most of these deformities to volvulus.

Meckel's diverticulum.—This is the remains of the omphalo-mesenteric duct, which in fœtal life forms a communication between the intestine and the umbilical vesicle. It is given off from the ileum, usually about a foot above the ileo-cæcal valve. Most frequently this exists as a blind pouch from one half to two or three inches long, communicating with the intestine. At the extremity of this there may be a fibrous cord, which may be free in the abdominal cavity or attached to the umbilicus. In other cases the duct may remain pervious to the umbilicus, so that there is a fæcal fistula. Prolapse of the mucous membrane of the duct may lead to an umbilical tumour. (See page 112.) Meckel's diverticulum, especially when present as a cord connecting the ileum to the umbilicus, may compress a coil of intestine, leading to obstruction or even strangulation. This may occur in infancy or later in life.

Malpositions.—The ascending colon may be found upon the left side. There may be a complete transposition of the abdominal viscera. In cases of congenital umbilical hernia a large part of the intestines may be found in the tumour, and in diaphragmatic hernia they may be in the thoracic cavity.

DIARRHŒA.

The term *diarrhœa* is used to cover all conditions attended by frequent loose evacuations from the bowels. These depend upon an increase in peristalsis and in the intestinal secretions. There are certain etiological factors which are common to all forms of diarrhœa.

Age.—A peculiar susceptibility exists in very young children. This is well brought out by the following statistics. My associate, Dr. Crandall, has tabulated three thousand cases of diarrhœa, including those treated by both of us in private and dispensary practice, and others from the records of two large dispensaries in New York. The ages of those applying for treatment were: under six months, 14 per cent; six to twelve months, 29 per cent; twelve to eighteen months, 24 per cent; eighteen to twenty-four months, 17 per cent; over two years, 16 per cent. It will be noted that the greatest susceptibility is between six and eighteen months, and that over four fifths of all the cases occurred during the first two years.

Season.—The next striking fact about diarrhœal diseases is their prevalence during the summer season. This is graphically shown in Figs.

50 and 51, where are given by months the cases treated in a large New York dispensary for ten years, and the mortuary records for the entire city during the same period. The enormous increase in the number of cases occurring in the summer months does not have reference to any single form of diarrhœa, but to all forms. The significance of these facts will be considered later.

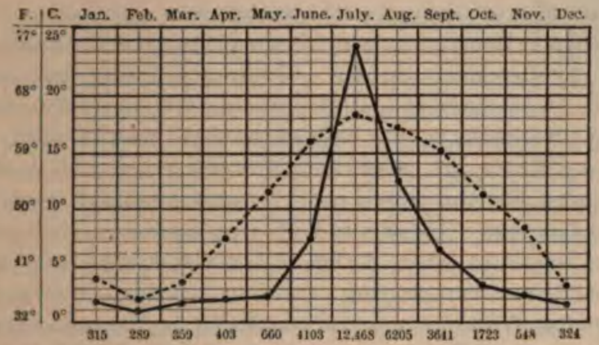

FIG. 50.—Mortality from diarrhœal diseases in New York for ten years in children under five; compared with the mean temperature for the same period. ——, mortality; - - - - -, mean temperature. (Seibert.)

Surroundings.—While diarrhœal diseases are especially frequent in cities and among the poor, still they are not essentially diseases of the city nor of poverty. Severe and even fatal cases are constantly met with among all classes and in all places. Sufficient evidence has not yet accumulated to establish a direct connection between a polluted atmosphere and the prevalence of diarrhœal diseases. They are not essentially filth-diseases; yet their frequency and severity are both increased by want of cleanliness in apartments, in the persons and clothing of infants, especially the napkins,

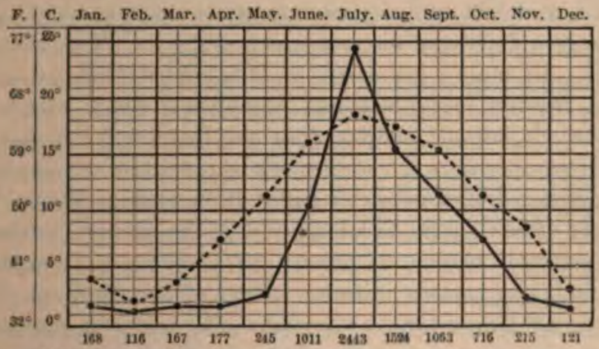

FIG. 51.—Cases of diarrhœal disease treated in the German Dispensary (New York) in ten years in children under five; compared with the mean temperature for the same period. ——, cases of diarrhœa; - - - - -, mean temperature. (Seibert.)

chiefly, it appears, as these lead to a contamination of the food. Vacher has shown that the mortality from diarrhœa in the large English towns had no constant relation to the density of population. Poverty, neglect, and bad surroundings, predispose to diarrhœa in summer, just as they do to other forms of acute disease in the cold season.

Constitution.—Everything which lowers the general vitality increases the liability to diarrhœal diseases. Children suffering from marasmus, malnutrition, syphilis, rickets, or tuberculosis are especially prone to be affected, and these make up the bulk of the fatal cases in cities.

Dentition.—There are cases in which diarrhœa and dentition are closely associated, for the bowels quickly become normal when the teeth have pierced the gum. These, although rare, do occur. Too much, however, can not be said in contradiction of the wide-spread belief among the laity that diarrhœa accompanying dentition is normal or even beneficial. The infrequency of diarrhœa during dentition in the cold season, is the best argument against its importance as an etiological factor.

Food and feeding.—Of 1,943 fatal cases which I have collected, only three per cent had the breast exclusively. In my own experience fatal cases of diarrhœal disease in nursing infants are extremely rare. These are significant facts. They show that the manner of feeding is one of the most important factors in the production of diarrhœa. This is to be connected with the statistics with reference to age. The poor in New York are wont to nurse their infants exclusively for about six months. If nursing is continued longer, it is usually with the addition of other food, often of the most indigestible kind. Children among the poor in tenements enjoy immunity from intestinal disease just in proportion as they are breast-fed, and just so long as they are so; but as soon as artificial feeding is begun, diarrhœal diseases are prevalent. There are many reasons for this. In most cases, however, it is not artificial feeding *per se*, but artificial feeding ignorantly and improperly done, which is to be blamed. If cow's milk is employed as a substitute for breast-milk, the differences in composition are either not appreciated or else ignored, so that many artificially-fed children suffer from malnutrition. The comparative safety of cow's milk in winter and in the country, however, shows that the difference in chemical composition is not the most important one. A common and very serious mistake is that of over-feeding. Artificially-fed children are almost always over-fed. The common practice of feeding an infant every time it cries, or of keeping the bottle at its mouth the greater part of the time, is productive of untold harm.

The feeding of impure or contaminated milk is an important cause of diarrhœa, especially among the poor in cities during the summer. The condition of the milk may be due to disease in the cow, to adulteration or pollution at the dairy, during transportation, or in the homes. It may come from dirty vessels in which the milk is kept, or dirty bottles from which it is fed. In some cases the milk may be the vehicle of specific infection. In others, its condition is owing to the ordinary fermentation changes due to the age of the milk—it being often two and sometimes three days old before it is consumed, and very often kept with little or no ice. It is surprising to see how quickly diarrhœa is excited by impure milk. I once saw in the New York Infant Asylum every one of the twenty-three healthy children, all over two years old and occupying one ward, attacked in a single day with diarrhœa which was traced to this cause. Articles of food totally unsuited to the child's digestion are often given. Among the poor it is a common practice to give all kinds of solid food to children from twelve to eighteen months old, while those of two years often get only the regular diet of the family. The great majority of the attacks of diarrhœa in children over two years old can be traced directly to improper food.

The factors mentioned—over-feeding, too frequent feeding, and the habitual use of improper food—all combine to produce a chronic indigestion which is probably the most important predisposing cause of diarrhœal diseases.

The Different Varieties of Acute Diarrhœa.—*Mechanical diarrhœa.*—This includes cases in which diarrhœa is produced by foreign bodies, or substances taken as food which virtually act as foreign bodies: such are partly-cooked rice or other cereals, dried fruits, or fresh fruits containing seeds; green corn, radishes, celery, cabbage, or other vegetables; nuts and unripe fruits. The irritation caused by such substances may produce only increased secretion and peristalsis by which the offending articles are removed, or, if sufficiently severe and continued, it may lead to actual inflammation of the mucous membrane of the intestine.

The indications for treatment are first to give an active cathartic—castor oil, calomel, or a saline—and, after thorough evacuation of the bowel has taken place, to quiet the excessive irritation by opium. The particular preparation used is not important. For two or three days after such an attack the diet should be very light, and of such a character as to leave but little residue—e. g., for infants, broth, beef juice, white of egg; and for older children, diluted milk or kumyss. The patient should be kept quiet, preferably in bed, until the stools are quite normal. The neglect of such mild attacks is a frequent cause of more severe ones.

Diarrhœa from drugs.—In susceptible infants any of the ordinary cathartic drugs may cause an attack of diarrhœa, because the physiological effects have been either exaggerated or prolonged. It is doubtful whether such attacks are often produced in nursing infants by cathartics taken by the nurse. The organic acids contained in fruits may operate in the same way as cathartic drugs. In cases like these the diarrhœa is readily controlled by opium, usually by small doses, which should be repeated after each action of the bowels.

Diarrhœa from nervous influences.—Certain nervous impressions seem to be able to produce diarrhœa where no other factors are present. Sometimes these act in conjunction with other causes. The most important are chilling of the surface, depression caused by atmospheric heat, fatigue, exhaustion, fright, and dentition. Diarrhœa may be seen in older children with anæmia, chorea, and general malnutrition. It is a characteristic of many of these cases, that the taking of food into the stomach immediately excites a movement of the bowels. The stools usually contain undigested food, because the intestinal contents are so rapidly hurried forward. The chief abnormal condition in such cases is exaggerated peristalsis. This is best controlled by rest and opium; small doses only are usually required.

Eliminative diarrhœa.—This term has been applied to cases in which diarrhœa is evidently an effort on the part of Nature to rid the blood of some irritant or toxic element. The best-known example is the diarrhœa of uræmia. It is, however, very probable that the diarrhœa of many acute infectious diseases belongs in this category. The danger of suddenly arresting such a discharge is a real one. It should be closely watched, and not allowed to become in itself a drain upon the patient, but checked only when excessive.

Acute intestinal indigestion.—Diarrhœa is a constant symptom of this condition, which is of such importance that it will be considered at length. The exciting cause of the diarrhœa may be either the mechanical irritation of particles of undigested food, or the various putrefactive products which take place from the decomposition of such food. This form is especially severe in infancy, and is usually accompanied by high fever and other marked constitutional symptoms. Gastric symptoms are present in most of the cases.

In the forms of diarrhœa above enumerated there are no lesions, and the bacteria found in the stools are the ordinary bacteria of the intestines. All other forms of acute diarrhœa are to be regarded as infectious, the infection starting from the intestinal contents. All of them also are associated with lesions, the severity of which depends upon the nature and degree of the infection, and the duration of the process. In the mildest cases and in those of short duration, the lesions involve only the superficial epithelium. In these the symptoms are due not so much to the anatomical changes, as to functional derangement and the presence of toxic materials in the intestine; some of these act locally and others produce constitutional symptoms by absorption into the general circulation. These have been classed as cases of *acute gastro-enteric infection.*

In the more severe forms, and in those of longer duration, the lesions may involve the entire mucosa, or they may extend into the submucosa quite to the muscular coat. They vary greatly in character as well as in degree. The lesions are very important, as modifying the symptoms, course, and termination of these cases. For this reason they are sometimes classed as cases of inflammatory diarrhœa; here, from the position of the lesions, they are grouped under the term *ileo-colitis*.

According to Booker's observations, the bacteria usually associated with the superficial lesions are bacilli; those with the deeper lesions, streptococci.

The pathological relation existing between the different forms of diarrhœal disease is a very close one. The same case may pass successively through the stages of acute indigestion, gastro-enteric infection, and ileo-colitis. This transition may be very slow, or it may be so rapid that the different stages can not be distinguished. Instead of passing through the entire series, the process may stop at any stage and the case recover, or it may at any stage prove fatal.

ACUTE INTESTINAL INDIGESTION.

In infants, acute indigestion is seldom limited either to the stomach or to the intestine, although in one case the disturbance of the stomach is slight and that of the intestine serious, and in another the reverse may be observed. In these little patients the intestinal symptoms are much more frequent, and as a rule they are more severe than those referable to the stomach. There will be considered in this connection only the intestinal symptoms of acute indigestion; the gastric symptoms have been described on page 291. It should be remembered that these may be seen in all possible combinations. In older children it is not uncommon to see the intestinal symptoms alone.

Etiology.—The causes are essentially the same as those mentioned under Gastric Indigestion—the use of improper food, over-feeding, sudden change of food as in weaning, and various conditions affecting the nervous system, such as heat, cold, fatigue, or the onset of any acute disease. A predisposition to such attacks is furnished by summer weather, a delicate constitution, and especially by a feeble digestion. This predisposition is greatly increased by previous attacks of acute or chronic indigestion or intestinal inflammation. In susceptible children, both infants and those who are older, the slightest error in feeding may induce an attack.

Symptoms.—In infants, if the attack develops suddenly, gastric symptoms are usually present; if more gradually, they are usually absent. The local symptoms are colicky pain, tympanites, and diarrhœa. The important constitutional symptoms are fever, prostration, and various nervous disturbances. In older children the pain generally precedes the diarrhœa by some hours, and is referred to the region of the umbilicus. In infants, pain is indicated by the sharp, piercing cry, great restlessness, and drawing up of the legs. Tympanites is rarely very marked, and may be wanting.

The stools are always increased in number and are from four to twelve a day. If more frequent they are very small. The first stools are more or less fæcal, but this character is soon lost. In infancy the colour is first yellow, then yellowish-green, and finally often grass-green. Wegscheider has shown that this colour is due to biliverdin. The exact nature of the process in the intestine, in consequence of which biliverdin takes the place of bilirubin as the colouring matter of the stools, is still a disputed point, but in infancy this change in colour is nearly constant. The reaction of the stools is almost invariably acid. The odour may be sour, or it may be very foul. The stools are thinner than normal, and after a few hours usually become almost fluid. Blood is not present, nor is mucus seen, unless the symptoms have lasted several days. Undigested food is always present; in infants upon a milk diet, this is seen as fat or lumps of casein. Fat may appear as small, yellowish-white masses resembling casein, but distinguished by their solubility in equal parts of alcohol and ether. Casein masses are more numerous, larger, and whiter. Unchanged starch may be recognised by the iodine reaction. The microscope shows, in addition to food-remains, mucus, epithelial cells, and bacteria. Epithelial cells, usually of the cylindrical variety, are numerous in proportion to the severity and duration of the attack. The bacteria are the ordinary forms found in the fæces (Booker).

In the cases with sudden onset the temperature is invariably elevated. In infants it ranges from 102° to 105° F.; in older children from 100° to 103° F. The high temperature does not continue. Usually after twelve or twenty-four hours it falls nearly or quite to normal. In the cases with a more gradual onset, or those of a less severe character, the temperature does not often go above 101° F. The general prostration, like the temperature, is greatest in infants and in the cases beginning abruptly. It is sometimes so severe as to threaten life. There are rapid pulse, pallor, drawn features, and general muscular weakness. There may be restlessness, due to pain and the general discomfort, or there may be dulness, apathy, or convulsions.

The course and termination of the disease depend upon the previous condition of the patient, the nature of the exciting cause, and the treatment employed. In a previously healthy child, if the cause is at once removed and proper treatment instituted, the severe symptoms rarely last more than a day or two, and in four or five days the patient may be quite well. In delicate infants, a severe attack of acute intestinal indigestion in the hot season, is likely to prove the first stage of a pathological process which may continue until serious organic changes in the intestine have taken place. This result may not follow the first attack, but one is often succeeded by others until it occurs. If circumstances are such that proper dietetic treatment and general hygienic measures can not be carried out, this termination is very common.

Diagnosis.—It is impossible to recognise an attack of acute intestinal indigestion until the diarrhœa begins; the previous symptoms of fever, prostration, etc., are seen in many infantile diseases. From the other forms of diarrhœa, this is distinguished by its brief duration, although its symptoms may be very threatening. The nervous symptoms are usually less marked than in gastro-enteric infection, and vomiting is not so frequent.

Prognosis.—Such attacks do not endanger life except in very young or very delicate infants, in whom they may be fatal. The worst feature of most cases is that such attacks predispose to more serious intestinal diseases, many of which have their origin in acute indigestion which has been either neglected or badly managed.

Treatment.—The same general plan is to be followed as in cases of gastric indigestion—viz., first, to empty the bowels as completely as possible of all decomposing or irritating masses of food; secondly, to secure to the patient, and especially to the digestive organs, as complete rest as possible. For the first indication nothing is better than calomel, which may be given in one-fourth-grain doses, and repeated every hour until the full effect is seen. Any other active purge, such as castor oil or syrup of rhubarb, may be substituted. Thirst is always great on account of the fever and the loss of fluid by the stools, but digestion even in the stomach is feeble, and often arrested altogether. For the first twenty-four hours no plan succeeds better than that of withholding everything in the shape of food, giving only such articles as whey, albumen-water, mineral waters, or cold boiled water. Small quantities must be given—i. e., one to four teaspoonfuls—but the interval may be as short as ten or fifteen minutes. If the prostration is very great, stimulants may be needed. Brandy is the best form of administration. After the offending materials have all been swept from the intestine, but never before, opium may be given in doses large enough to control the excessive catharsis. For a child a year old, one quarter grain of Dover's powder after each stool is usually sufficient, and often a smaller dose may answer the purpose.

The difficult problem is to feed these cases during the latter part of the attack. In nursing infants, the breast may be begun after twenty-four hours, the nursing interval being six hours, and the time of one nursing being not longer than five minutes. Between the nursings other food may be given. In the case of infants past the nursing age, or those who are being artificially fed, cow's milk must be withheld in all forms for at least three days, and then given greatly diluted. For infants under six months, not more than one part of milk to seven of water should be employed. Milk sugar, in the proportion of one even tablespoonful, should be added to each eight ounces of food. Such a mixture has the following composition: fat, 0·4 per cent; sugar, 5·0 per cent; proteids, 0·5 per cent. In some cases it is necessary to use even so great a dilution as one part of milk to twelve of water, and one tablespoonful of the milk sugar to each ten ounces of food. This contains approximately: fat, 0·25 per cent;

sugar, 4·0 per cent; proteids, 0·3 per cent. With improvement, the proportions of the fat and proteids must be very gradually increased, as for some time the digestion is easily disturbed. In some cases there is an advantage in using partially or completely peptonized milk (page 148).

The diet of older children in the acute stage should be much like that of infants. Later it should consist of meat, broths, eggs, milk, and a small quantity of dried bread. All cereals, vegetables, and especially all fruits, should be withheld for some time, and when given should be allowed only in small quantities, and the effect on the stools watched. Kumyss and matzoon are frequently better borne than plain milk.

The use of drugs in these attacks, except those already referred to as indicated during the early stage, seems to me to influence the disease very little. Sometimes good results follow the giving of the extractum pancreatis half an hour after meals, or of some of the preparations of malt when farinaceous food is first allowed. If the diarrhœa following the acute symptoms is prolonged or excessive, it usually indicates that either intestinal infection or inflammation is present, and the case should be treated accordingly. General measures, such as rest, frequent bathing, fresh air, and change of air, are very important in the management of all these cases, especially when they occur during the summer.

CHAPTER VII.

DISEASES OF THE INTESTINES.—(Continued.)

ACUTE GASTRO-ENTERIC INFECTION.

Synonyms: Summer diarrhœa, gastro-intestinal catarrh, gastro-enteritis, cholera infantum, mycotic diarrhœa.

THIS is the form of diarrhœa which is so prevalent in summer. It occurs regularly each season as an epidemic in most large cities of the temperate zone, the lesions in the intestines are slight, amounting in most cases only to a superficial catarrhal inflammation, often bearing no relation to the severity of the symptoms which are mainly due to the absorption of toxic materials, the result of the putrefactive changes in the stomach and intestine. This form of diarrhœa may follow closely upon an attack of acute indigestion, in which it very often has its beginning. When the infection is of sufficient intensity and duration, it leads to the development of marked structural changes in the intestine, especially in the lower ileum and the colon. Acute gastro-enteric infection thus stands midway between acute indigestion and ileo-colitis.

Etiology.—Among the causes of acute gastro-enteric infection are to be mentioned, first, those which give rise to acute indigestion, and, secondly, the general factors mentioned as predisposing to all forms of diarrhœal disease—age, surroundings, constitution, food, and methods of feeding. (See page 310.) The most striking thing about these cases is their prevalence during hot weather; hence this feature demands a closer examination. While all varieties of diarrhœa are more frequent in summer, it is the form under consideration which is especially prevalent. Year after year are repeated in New York the conditions which are graphically represented in the charts on page 309—viz., an epidemic which beginning in June rapidly increases in severity reaching its height in July, from which time it diminishes steadily during August and September, regularly coming to an end in October. What is true of New York is also true of Philadelphia, Baltimore, and other large American cities, as well as of Berlin and other cities of central Europe. A study of these charts shows that while the mean temperature rises gradually during April and May, it is not until June is reached with its mean temperature of 61° F., that any notable increase in diarrhœal diseases begins. It appears then that an average mean temperature, or, according to Seibert, an average minimum temperature, of about 60° F. is needed to start the epidemic. Not many cases are seen until such a temperature has lasted for some days, usually about a week. The epidemic then begins in force and increases in severity through July. The explanation of the high mortality of this month appears to be, not the 4° or 5° F. by which the temperature of July exceeds that of June and August, but that the majority of the susceptible infants are unable to withstand the first very hot month. Humidity and rainfall, according to the careful investigations of both Seibert in New York and Baginsky in Berlin, do not influence either the prevalence of summer diarrhœa or its mortality.

The action of heat in producing diarrhœa was formerly regarded as a direct one. The worst cases were looked upon as examples of heat-stroke or thermic fever. There is no doubt that the constitutional depression produced by high atmospheric temperature may seriously interfere with digestion, and that sometimes the thirst which excessive perspiration produces may lead to the giving of too much food, which also may be a cause of indigestion. While this explanation may be satisfactory for a small proportion of the cases, it is not adequate for the great majority. The view almost universally held at the present time regarding summer diarrhœa is that it is of infectious origin. The grounds for this opinion are briefly as follows: A certain temperature is required, which is the same as that at which the growth of bacteria begins to be very active. This disease prevails to the extent to which other food than breast-milk is given to infants. Thus it affects infants after weaning, and those younger who are partly or entirely fed upon cow's milk, or at least who are not nursed. Cow's milk, as ordinarily handled, contains in summer an enormous number of bacteria (page 144), which increase directly with the age of the milk and the height of the temperature at which it is kept. It has been shown by Vaughan and others that certain substances may be produced in milk which are capable of exciting in animals all the symptoms of severe cases of cholera infantum. In the milk which children had been taking when such symptoms developed, the same toxic substances were found. The two diseases to which summer diarrhœa has the closest analogy—typhoid fever and cholera—are both due to a specific infection.

During the past few years extended bacteriological studies of the intestinal discharges in these cases have been made, particularly by Booker (Baltimore) and Baginsky (Berlin). The results thus far obtained have failed to establish the connection between any single form of bacteria and any variety of diarrhœa. The forms most frequently associated with cases of the cholera-infantum type belong to the proteus group. The varieties found in the other cases have been chiefly the ordinary saprophytic bacteria, prominent among which is the hay-bacillus (Flügge). These germs gain entrance to the body, in the great majority of cases, through milk, although it is possible that water may sometimes be the vehicle. Whether they may be taken in with the inspired air is very questionable. In most of the cases it is probably the living bacteria which enter the body, while in others the symptoms are produced by taking food in which poisonous products have already been formed by the action of bacteria. The latter seems to be the explanation of some of the cases in which symptoms come on almost immediately after the ingestion of contaminated milk.

The acceptance of the view of the infectious character of summer diarrhœa, brings up the interesting question of direct contagion. With our present knowledge we can not believe that this is often, if it is ever, the way in which this disease is spread. When occurring in institutions or in families, it usually happens that a number of cases are attacked simultaneously rather than successively, this indicating a common cause, usually to be found in the food, for all. However, we know enough about the spread of typhoid fever and cholera from fæcal discharges, to appreciate the importance of careful disinfection of all stools and napkins, particularly in institutions.

Relation of the different etiological factors.—The predisposition to attacks of summer diarrhœa is partly general and partly local. The general influences are age (under two years), feeble constitution, unhygienic surroundings, and a condition of general malnutrition dependent upon improper food or feeding. The most important of the local causes is a chronic derangement of digestion, usually the result of improper feeding. In addition there may be present a low grade of catarrhal inflammation. The exciting cause of an attack may be acute indigestion. In consequence of an arrest of digestion, there is left in the stomach and intestines food which readily undergoes decomposition; and at the same time there are furnished conditions in which bacteria may develop, which, though previously present, were unable to gain a foothold; or bacteria may be introduced in such numbers and of such virulence as to overpower the digestive organs; or, finally, bacterial products may be ingested with the food, requiring only absorption to produce their effects.

Lesions.—The statements which follow are based upon a study of forty autopsies, in twenty-two of which microscopical examinations were made. The lesion may be briefly described as a superficial catarrhal inflammation affecting the entire gastro-enteric tract, although it varies much in severity in the different regions and in the different cases. The colon, the lower ileum, and the stomach, are apt to suffer most, the duodenum and the jejunum least.

The gross appearances.—These are usually disappointing, and may often show but little that is abnormal. The stomach is distended with gas, and contains undigested food. Its walls may be coated with mucus. The upper part of the small intestine is empty. The lower portion contains particles of food, and yellow, gray, or green materials, often offensive, resembling the stools passed during life. The transverse colon, the cæcum, and sigmoid flexure are apt to be distended with gas, and contain materials similar to those mentioned, while the rest of the large intestine is usually empty and its walls contracted. It may be coated with mucus. The mucous membrane of the stomach may show intense congestion, generally in patches, or it may be pale. The mucous membrane of the small intestine may be pale throughout; there are often irregular areas of congestion, or a very intense congestion of a large part of its surface, particularly in the ileum. With this there may be redness and swelling of Peyer's patches and the lymph nodules (solitary follicles). In the colon the mucous membrane is congested, especially upon the rugæ. This congestion may be general or in patches. The lymph nodules are usually swollen; but this may be due to an antecedent process, and not to the final attack. There is no thickening of the intestinal walls. The changes described are not at all uniform, and do not differ very greatly from the appearances often seen in the intestines when patients have died of other diseases.

In the cases classed clinically as cholera infantum, the pathological changes are more characteristic. The greater part of the small intestine, and sometimes the entire colon, are distended with gas, and contain materials of a grayish-white colour about the consistency of a thin gruel. It has a mawkish odour, but usually not a very offensive one. The mucous membrane of the entire intestinal tract has in most cases a pale, "washed-out" appearance. Sometimes this is seen only in the small intestine, while there are areas of congestion in the colon. If cholera infantum has been ingrafted upon some other pathological process in the intestines, as is not infrequent, there is found post-mortem evidence of this in the form of severe catarrhal inflammation, sometimes old ulcerations. In some cases, where the symptoms have been those of choleriform diarrhœa, there are found evidences of an intense diffuse gastro-enteritis, as shown by congestion of the stomach and almost the entire intestinal tract, with swelling of the mucous membrane, and especially of Peyer's patches.

*The microscopical appearances.**—Unless autopsies are made very soon after death—at least within four hours—it is not safe, in most of the cases, to draw conclusions from the conditions found; as post-mortem changes take place so readily in the intestines, and these changes are so like those of the disease under consideration. This applies particularly to the condition of the epithelium. One should also be cautious in interpreting the appearances of portions of the intestine which have been greatly distended with gas. The essential lesions of this disease are found in the superficial epithelium of the stomach and intestine. In places this has disappeared. In other places the cells are in position, but both the cell protoplasm and the nuclei are so changed that they do not stain normally. Bacteria, usually bacilli (Booker), are found in the epithelial layer and in the pockets of the follicles. They are not, as a rule, found in the deeper parts of the intestinal wall, nor in the lymph nodes of the mesentery. The changes in and about the blood-vessels are variable. The small vessels may be distended, and there may be hæmorrhages or an exudation of leucocytes in their neighbourhood. These appearances are seen either in the mucous or submucous layer. The exudation from the blood-vessels is usually slight, and in many cases is wanting. Peyer's patches and the lymph nodules may be enlarged from cell-proliferation. Pathologically no sharp line can be drawn between these lesions and those of the early stage of ileo-colitis; the latter affect the lower ileum and colon chiefly, often exclusively, and the lesions are more advanced and involve the deeper parts of the intestinal wall.

Clinically, there are two quite distinct forms of gastro-enteric infection, which will be separately considered—(1) the simple form and (2) true cholera infantum.

SIMPLE GASTRO-ENTERIC INFECTION.—There are seen in infants mild cases with a gradual onset, little or no fever, and no gastric disturbance, and severe cases with a sudden onset, usually attended by high temperature and by vomiting. In the mild form, there may be for the first few days no symptoms except the diarrhœal discharges, or the children may be peevish and fretful—especially at night—and may seem generally out of sorts. From the fact that the general symptoms are so few, such cases are often allowed to go on for several days, under the impression that the children are "only teething." The stools gradually become more frequent; they are thin, green, yellow, or brown, and always contain undigested food. After a time the odour becomes offensive, and mucus is present. The appetite may be normal, but is usually impaired, and may be almost lost. The tongue is coated, the mucous membrane of the mouth congested, and in very young infants often covered with thrush. The general health may not be noticeably affected for several days; but more often the infants become pale, their limbs grow soft and flabby, they lose their spirits, they are fretful, they sleep badly, and the scales show a loss of one or two pounds in a week.

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* For fuller description, see article by the author in Keating's Cyclopædia, vol. iii, p. 80.

With proper treatment, there is noticed in favourable cases an improvement in the character and frequency of the stools; the appetite returns; the strength and spirits improve; and the children recover after an illness of from one to three weeks. Occasionally the condition may last a much longer time. Relapses are very easily brought on by errors in diet, especially by overfeeding. In other cases severe symptoms may supervene at any time, and the case may become one of the cholera-infantum type. This often takes place with great suddenness, and is frequently coincident with a few days of very hot weather, or follows some gross dietetic error. In still others the symptoms may continue with the gradual formation of follicular ulcers, the case becoming one of ileo-colitis. A termination, not so common as either of the preceding, is a continuance of the mild symptoms with exacerbations and remissions, until the cool weather of autumn comes.

In the cases developing suddenly, the clinical picture is quite a different one. The attack may begin abruptly in a child previously healthy, or there may have been for some days a slight intestinal derangement. If an infant, it is restless, cries much, sleeps but a few minutes at a time, and seems in distress. The skin is hot and dry, the temperature rises rapidly to 102° or 103° F., often to 105°, and all the symptoms indicate the onset of some serious illness. The infant may lie in a dull stupor, with eyes sunken, weak pulse, and general relaxation, or there may be restlessness, excitement, even convulsions. There is great thirst, so that everything offered is eagerly taken, or everything may be refused. Usually, in the course of from four to six hours after the onset, vomiting begins; it is first of undigested food taken many hours before. If this was milk, it comes up in hard curds and very sour. Even after the stomach has been apparently emptied, mucus, serum, and sometimes bilious matters, are ejected in small quantities after much retching. Vomiting is easily excited by the giving of food or drink.

Diarrhœa soon follows—first fæcal stools, then great bursts of flatus, with the expulsion of a thin yellow material with an offensive odour. Four or five such discharges may occur in as many hours. In other cases the stools are gray, green, or greenish-yellow, sometimes brown. They often do not differ at first from those of an ordinary attack of acute intestinal indigestion. The most characteristic features are the amount of the gas expelled, the colicky pains preceding the discharges, and the foul odour. After the first day the stools may be almost entirely fluid, varying in number from six to twenty a day, and often large even then. Their offensive character usually continues. After two or three days mucus may appear. The microscopical examination of the stools shows, besides the things mentioned in the stools of acute indigestion, great numbers of separate epithelial cells, and sometimes groups of cells attached to a basement membrane. In addition there may be round cells and some red blood-corpuscles. The bacteriological examination shows that the normal varieties are usually diminished in number, while many new forms are present, chiefly putrefactive bacteria.

In many cases the free evacuation of the bowels is followed by a drop in the temperature and subsidence of the nervous symptoms, and the child may fall asleep, to be awakened for an occasional stool after a few hours. The prostration, though often great in the beginning, is not usually of long duration. Under the most favourable circumstances, after one or two days of severe symptoms, the case goes on to a rapid convalescence. The stools continue abnormally frequent for five or six days, but gradually assume their normal character, and a prompt recovery occurs. The chief features contributing to such favourable results, are a good constitution on the part of the child and one's ability to regulate the feeding afterward.

If the circumstances are not so favourable, if the infant is very young, delicate, or cachectic, there may be no reaction from the first storm of symptoms, and the attack may terminate fatally. In such cases the temperature continues elevated from 100° to 103° F., sometimes higher. The stomach is irritable and rejects everything. The stools continue thin, green, and are often irritating to the anus and skin. There is steadily increasing prostration, and death may take place from exhaustion in semi-stupor or in convulsions. In other cases the vomiting ceases, the temperature falls, the stools become less frequent and perhaps less offensive, but contain more mucus and occasionally traces of blood. There is also some reaction from the early nervous depression, but the children become pale, worn, and waste steadily. The temperature ranges between 99° and 102° F., and all the symptoms belonging to ileo-colitis gradually develop. Sometimes there may be a series of such acute attacks separated by a week or ten days, the stools never becoming quite normal between them, but all other symptoms being absent. It may not be until the third or fourth attack that ileo-colitis is finally established.

In children over two years old there are seen some features which differ from the cases described above as occurring in infants. Vomiting does not come on so readily as in infants, pain is a more prominent symptom, and the temperature, as a rule, is lower. Such cases, although beginning with severe symptoms, usually make good recoveries; there is much less likelihood of their going on to the development of ileo-colitis than in the case of infants.

Diagnosis.—The diagnostic points about these attacks are their sudden onset, severe symptoms, comparatively brief duration, and usually favourable termination. Attacks of acute gastro-enteric infection can not always be distinguished from acute indigestion, but as a rule they are characterized by a higher temperature, greater disturbance of the nervous system, very offensive fluid stools, and by occurring epidemically in summer. To differentiate these cases from those of ileo-colitis, may be impossible for the first two or three days. The onset may be identical in both cases. The continuance of high temperature beyond the second day points to inflammatory changes; so also do the appearance of blood and of much mucus in the stools, and the existence of continuous pain.

Almost any acute disease in infants may be ushered in with gastro-enteric symptoms, especially in summer. This is particularly true of scarlet fever, pneumonia, tonsillitis, and malaria. Each one of these is to be recognised by its peculiar symptoms: pneumonia, by its rapid respiration and physical signs; tonsillitis, by the appearance of the throat; scarlet fever, by the appearance of the throat and the eruption; malaria, by the enlarged spleen and remittent temperature. One should look for some other disease whenever there is seen very manifest improvement in the gastro-enteric symptoms, with a continuance of the high temperature and general prostration.

Prognosis.—Simple cases of gastro-enteric infection do not often prove fatal, except in infants under three months old or those already suffering from marasmus. Such patients are often overcome in the first stage of intoxication. It is surprising to see with how few symptoms they succumb. Even an apparently mild attack may prove fatal, and a guarded prognosis must always be given.

In other cases the prognosis resolves itself into this question: What are the probabilities that the existing attack will go on to the development of serious intestinal lesions? If the child has been delicate, badly fed, has suffered from frequent attacks of indigestion and diarrhœa, if its surroundings are bad, if the case has been neglected for two or three days, and if proper dietetic and hygienic treatment can not be carried out, it is probable that the process will continue until structural changes in the intestine have taken place. The degree of probability is in proportion to the number of these factors present. Manifestly, all the conditions are worse in hot weather. Much depends upon early treatment and upon our ability to remove the exciting causes. If the patient was previously suffering from any other disease, such as rickets or pertussis, the prognosis is much worse both as to life and to the duration of the attack.

Prophylaxis.—So long as dentition and atmospheric heat *per se* were regarded as the great causative factors, the field of prophylaxis was limited; but a better understanding of the etiology brings with it great possibilities in the prevention of this disease.

Prophylaxis must have regard, first, to the hygienic surroundings of children, and to all sanitary conditions in the cities—cleaner streets and more parks. In the tenement homes and all institutions for infants, there should be more air and sunlight, less crowding, greater cleanliness about the persons of children, frequent bathing, and proper care of napkins. In summer, napkins should either be washed immediately or thrown into a disinfectant solution. In case infants are suffering from diarrhœa this latter plan should invariably be followed. City children should be sent to the country, wherever it is possible, for the months of July and August. Part of the benefit here is derived from the change of air, and a larger part from the pure milk, which is almost out of the question for the poor in the city. Where a long stay is impossible, day excursions do much good. The fresh-air funds and seaside homes have done more in New York to diminish the mortality from diarrhœal diseases in summer than all medicinal treatment; their importance and value can not be overestimated.

The second part of prophylaxis relates to foods and feeding. Maternal nursing should be encouraged by every possible means. No weaning should be done, if it can be avoided, during summer. Nothing is better established than the close relation existing between artificial feeding and diarrhœal diseases. I have elsewhere stated my belief that in the great majority of the cases it is ignorant and improper artificial feeding which is the real cause. The general rules laid down elsewhere on the subject of artificial feeding must be carried out, as to the quantity of food, frequency of feeding, modification of cow's milk, and all matters relating to the care, transportation, and sterilization of milk. Whatever causes indigestion, whether it be acute or chronic, may also be ranked as a cause of diarrhœal diseases. The important dangers to be emphasized in this connection are overfeeding, too frequent feeding, the use of improper foods, and use of impure foods, especially milk.

Overfeeding is particularly to be avoided during days of excessive heat. It is at such times an excellent rule with infants to diminish each meal by at least one third, making up the deficiency with water, and to give water very freely between the feedings. All water given to infants or young children should first be boiled. Children, like adults, require less food in very hot weather, but more water. Infants cry from thirst and heat, and even those at the breast are likely to be given too much food. Infants should never be fed more frequently during hot weather, but generally less so.

No greater work of philanthropy can be done among the poor in summer, than to provide means whereby pure, clean milk for young children can be supplied at the price now paid for an inferior article.*

Early and prompt attention should be given to all the milder derangements of the stomach and intestines. The larger proportion of serious attacks are preceded for some time by milder symptoms, which are often easily managed by prompt attention at the outset. Too much can not be said in condemnation of the practice of allowing a diarrhœa to continue for a week or more, simply because the child happens to be teething. Yet many mothers believe such a condition of the bowels to be, not only not injurious, but positively beneficial.

In brief, prophylaxis demands (1) sending as many infants out of the city in summer as possible; (2) the education of the laity up to the importance of regularity in feeding, the dangers of overfeeding, and as to what is a proper diet for infants just weaned; (3) proper legal restrictions regarding the transportation and sale of milk; (4) the exclusion of germs or their destruction in all foods given, but especially in milk, by careful sterilization in summer, and by scrupulous cleanliness in bottles, nipples, etc.; (5) prompt attention to all mild derangements; (6) cutting down the amount of food and increasing the amount of water during the days of excessive summer heat.

Hygienic Treatment.—If the attack occurs in the city in midsummer, and does not yield in three or four days to the treatment employed, the child should be sent to the country, if possible. In the case of an infant under a year this is imperative. Usually the seashore is to be preferred to the mountains, but this is not so important as it is that the child shall go where it is likely to have the best food and the best surroundings. Children must not only be sent away; they must be kept away until quite recovered. In the country or in small towns a change is not so necessary, and, in fact, not generally required. In cases which have become somewhat chronic, more can sometimes be accomplished by a change of air than by all other means.

Fresh air is of the utmost importance for all diarrhœal cases in summer. No matter how much fever or prostration there may be, these cases always do better if kept out of doors the greater part of the day. Nothing is so depressing as close, stifling apartments. Children should be kept quiet, and especially should not be allowed to walk, even if they are old enough and strong enough to do so. They can be kept out in carriages, in perambulators, or in hammocks.

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* Something of this has already been done in Boston by the milk laboratory, and in New York by the milk dispensary in connection with the Good Samaritan Dispensary, which has been organized by Koplik to furnish "sterilized" milk for infants; and also by the Straus milk depots, where the same thing is done on a much larger scale, this charity having branches in half a dozen districts of the city.

The clothing should be very light flannel; a single loose garment is preferable. Linen or cotton may be put next the skin if this is very sensitive and there is much perspiration. At the seashore and in the mountains, special care should be taken that sufficient clothing at night is supplied.

Bathing is useful to allay restlessness, as well as for cleanliness and the reduction of temperature. For the first purpose a sponge bath of alcohol and water or vinegar and water, is sufficient. For the reduction of temperature, only the tub bath is to be relied on. If the temperature continues above 102° F., systematic bathing should be employed. The temperature of the bath should be about 100° F. when the child is put into it, and should then be gradually reduced to 80° or 85° F. by adding ice. The bath should be continued for from ten to twenty minutes, according to the requirements of the case. Thus used, it has generally a very quieting effect, which is entirely lost by the terror and excitement caused by putting a young child suddenly into a cold bath.

Scrupulous cleanliness should be secured in the child's person and clothing. Napkins, as soon as soiled, should be removed from the child and from the room and placed in a disinfectant solution. Excoriations of the buttocks and genitals are to be prevented by scrupulous cleanliness and the free use of some absorbent powder, such as starch and boric acid.

Dietetic Treatment.—It is of the first importance to remember that during the early stage of the acute cases, digestion is practically arrested. To give food at this time, manifestly can only do harm.

In nursing infants, the breast must be withheld so long as a disposition to vomit continues, and no food whatever given for at least twelve hours. Thirst may be allayed by giving frequently, but in small quantities, cold whey, barley or albumin water. Stimulants may be added to these if required. If they are refused or vomited, absolute rest to the stomach will do more than anything else to hasten recovery. After the stomach has been quiet for twenty-four hours, it is generally safe to allow the child to be put to the breast tentatively. The intervals of nursing should not be shorter than four hours, and the amount allowed at one feeding should not be more than one fourth the usual quantity. This may be regulated by allowing an infant to nurse at first only two or three minutes. Between the nursings may be alternated, whey, barley water, or albumin water, so that something is given every two hours. Nursing may be gradually increased, so that in three or four days the breast may be taken exclusively. If there is any reason to suspect the breast milk, such as menstruation, pregnancy, or some special nervous disturbance, it may be necessary to stop the nursing temporarily or permanently, according to circumstances, and secure a wet-nurse or begin artificial feeding. In infants just weaned the same plan is to be followed.

In infants under four months who are being artificially fed, if the attack be a severe one and occur in summer, a wet-nurse should be secured wherever this is possible. If this is out of the question, we have to face one of the most difficult problems in artificial feeding. Cow's milk must always be withheld entirely during the stage of acute symptoms, and for several days longer. When it is begun, both the casein and the fat must be very greatly reduced by dilution, and in many cases the casein predigested. For young infants, milk should be diluted from six to ten times, and preferably with a sugar solution. (See formulæ XVII and XVIII, page 176). Instead of using only a sugar solution, part of the dilution may be with barley or rice water. In some cases it may be sufficient to peptonize milk for ten or twenty minutes; but in many we must do more, at first continuing the peptonizing for two hours, or until the digestion of the casein is complete (page 148). Kumyss and matzoon are sometimes retained when cow's milk is rejected. These should be diluted with two or three parts of water and given cold. They may sometimes advantageously be continued as the sole diet for several days. During the period of acute symptoms we must rely upon the substitutes for milk—rice or barley water, wine whey, the malted foods, albumin water, fresh beef juice, animal broths, and the liquid beef peptonoids.*

The same general principles of feeding must be applied in older children. All food is to be withheld until the vomiting ceases, and then broths and beef juice given; later, kumyss or matzoon, then milk, or thin gruels made with milk. Solid food should not be allowed for several days after the stools have become normal.

General principles of feeding.—All food, but especially cow's milk, must be stopped at once. No food whatever is to be given upon a very irritable stomach; but thirst must always be relieved by bland fluids given frequently in small quantities, and cold. Articles requiring the least digestion and leaving the smallest residue should next be tried. Food prescriptions must be made with the same care and exactness as those for drugs, for in most cases they are more important. Quantity and frequency must be definitely stated, as well as the articles ordered. Directions should be given in writing, or they will be forgotten before the physician is out of the house. A practical acquaintance with the proper appearance and taste of every food ordered, is absolutely indispensable. It is a common mistake to give too much at a time, to feed too frequently, to try too many articles at once, and to change before a thing has been fairly tested. For a single feeding the quantity allowed will vary according to the tolerance of the stomach, but it should always be much less than is given in health, usually from one fourth to one half that amount. It is very rarely, if ever, necessary to nurse or feed a sick child oftener than every two hours. In cases of great prostration, stimulants may be required much more frequently. We have only to imagine how an adult suffering from nausea would feel to be offered something in the shape of food every five or ten minutes, in order to appreciate the disgust for all food which soon overtakes an infant who is similarly besieged.

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* These foods are considered at length on pages 150–157.

Still, after all has been said, it is a difficult problem to feed these children under three years of age, capricious as they are by nature and still more by education, and the judgment and tact of the physician are taxed to their utmost. We must have many resources, for a food which one child takes well the next disdains utterly. The best plan is to select from a list of articles of accepted value, such as circumstances will permit, and such as are most likely to be properly prepared, and try them patiently, one after another, until one is found which the child under treatment will take, and one which agrees with him.

Medicinal and Mechanical Treatment.—It must be borne in mind that we are not treating an inflammation of the stomach or intestines, although such may be the ultimate result of the process. Our therapeutic measures are to be directed against the acute indigestion and the active putrefaction in the alimentary tract.

The first indication is, therefore, to evacuate the stomach and the entire intestinal tract at the earliest moment, and to do this as thoroughly as possible. Under no circumstances should the treatment be begun with the use of measures to stop the discharges.

To empty the stomach is not necessary in every case, since the initial vomiting may have done this efficiently. Whenever vomiting persists immediate resort should be had to stomach-washing (page 60). A single washing is generally sufficient, and if employed at the outset may do much to shorten the attack. If there are high fever and great thirst, it is often advisable to leave an ounce or two of water in the stomach. If the vomited matters have been very sour, ten grains of bicarbonate of soda may be introduced with the portion which is to be left behind. To older children emetics may be given, but to infants never. As a substitute for stomach-washing in children over two years old, or where it can not be employed, copious draughts of boiled water may be given. This is taken readily, and as it is usually vomited almost at once it may cleanse the stomach thoroughly; but it is inferior to stomach-washing.

To clear out the small intestine, only cathartics are available. For the colon, we may in addition employ irrigation. Calomel and castor oil are greatly superior to all other cathartics. Calomel has the advantage of ease of administration, of a favourable effect upon vomiting, and of an antifermentative as well as purgative action. One fourth of a grain should be given every hour up to eight doses, or until the characteristic green stools are seen. When the stomach is not disturbed, I prefer castor oil in most cases, as it sweeps the whole canal, causes little griping, is very certain, and its after-effects are soothing. It is important that a full dose be given—two drachms to a child a year old, and half an ounce to one of four years.

Irrigation of the colon (page 63) is advisable in all cases, as it hastens the effect of the cathartic and removes at once much irritating and offensive material. It should be done two or three times the first day, but afterward once daily is sufficient. A saline solution (one ounce to the gallon), at a temperature of about 90° F., is to be preferred; and a long rectal tube should always be used. The initial evacuation, almost complete starvation for twenty-four hours, and careful feeding after that time, are all the treatment that is necessary in a large number of cases.

Other drugs are of secondary importance. Their value is certainly very much overestimated. This statement is made after a thorough and honest trial, in hospital and private practice, of most of those that have been recommended. Since the recognition of the fact that putrefactive processes play so important a rôle in these cases, the drift of opinion and practice has been toward the use of drugs believed to act in the alimentary tract as antiseptics. In using drugs the conditions usually present are to be kept in mind: the digestive process in the stomach and upper small intestine is feebly carried on, and there is very active decomposition in the lower part of the small intestine and in the colon. In comparison with the intestinal contents, the amount of any drug which can be administered is so small, the conditions in the intestine are so complex, and our present knowledge of the exact nature of the processes of fermentation or decomposition which we wish to control is so limited, that it is extremely doubtful whether such a thing as antiseptic medication of the gastro-enteric tract is practicable at the present time. It is more than probable that a very large number of the drugs given to influence this process, never reach that part of the intestine where the most active decomposition is going on. Experience has shown that certain drugs which have been classed as antiseptics are valuable, but as yet we must use them empirically. Those in my experience which have been found most useful are bismuth, calomel, salol, and salicylate of soda; although the list might be very much extended.

Bismuth has the advantage that it rarely causes vomiting, and that most of its preparations can be given in large doses. Of the newer preparations, the salicylate, subgallate and beta-naphthol bismuth, the subgallate is easily superior to the others. This may be given in doses of from two to four grains every two hours, to a child of one year. Like the subnitrate it is insoluble and is best given suspended in mucilage. The salicylate may be given in the same doses as the salicylate of soda. For the great majority of cases, however, I think the subnitrate is still to be preferred. To be efficient, at least two drachms of this should be given daily to a child two years old. It usually blackens the stools. It may be kept up throughout the attack. Calomel may be given in doses of one twentieth to one tenth grain every hour. Its best effects are seen where it is used early in the disease. It should not be continued for more than twenty-four or thirty-six hours. The gray powder may be given in the same manner. Salicylate of soda is probably decomposed in the stomach, setting free salicylic acid; to a child of one year, two grains may be given, dissolved in water, every two hours, after feeding. This is not to be used if the stomach is very irritable, as it may excite vomiting. Its best effect is seen after the vomiting has stopped, and when the stools are fluid. It should be given alone. Salol is decomposed in the intestine into salicylic and carbolic acids. To a child of two years one grain may be given every two hours; sometimes more will be borne. It may be given alone, or with bismuth. This also may cause vomiting. Acids have been recommended, on the ground that the gastric contents, when examined, show a deficiency of hydrochloric acid, and from the experiments of Pfeiffer, which indicate that green stools are dependent upon an alkaline fermentation in the intestine. The acids most used are hydrochloric and lactic. Of the former, from one half to three drops of the dilute acid may be given, well diluted with water, every two hours, fifteen minutes after feeding. Of the latter, slightly larger doses may be used. They are not indicated in the most acute cases when vomiting is present, or when the stomach is easily disturbed. The best results are seen from them in the later stages and in the subacute cases. Acids are best given alone. Alkalies are of value only in acute cases, especially where there is acid fermentation of the stomach, with vomiting and eructations of gas. Limewater, bicarbonate of soda, magnesia, or chalk mixture may be employed. My own experience accords with that of most recent writers in attributing to astringents little or no value. They often do positive harm, by disturbing the stomach and interfering with digestion.

While opium in some form or quantity is required in many cases, as often used it undoubtedly does more harm than good. The chief symptoms indicating opium are great frequency of movements and severe pain. It is contra-indicated until the intestinal tract has been thoroughly emptied by cathartics and by irrigation; also when the number of discharges is small, particularly if they are very offensive; it is especially to be avoided when cerebral symptoms and high temperature coexist with scanty discharges. Opium is admissible in the early part of the disease after the tract has been thoroughly emptied; it is also useful sometimes during convalescence, when the administration of food is followed immediately by a movement of the bowels; and when, without an elevation of temperature, often with good appetite, the stools are frequent and contain undigested food, because peristalsis is so active that the intestinal contents are hurried along with such rapidity that there is not time for complete intestinal digestion and absorption. Nothing requires nicer discrimination than the use of opium in diarrhœa. It is wise to administer it always in a separate prescription, and never in composite diarrhœal mixtures. In this way it can be regulated according to the effect produced upon the number of stools. If, following the administration of opium, the stools, though diminishing in number, do not improve in character, and the temperature rises, the dose must be greatly reduced or the drug stopped altogether. There is no great choice as to preparations. Dover's powder, the deodorized tincture, and paregoric are perhaps the most satisfactory. As to dosage, great variations are required in the different cases. Enough is to be given to produce a certain effect—the diminution of pain and the control of excessive peristalsis—but never enough to check the number of discharges entirely, or to cause stupor. The uncertainty of absorption must also be remembered; a second full dose should not be given until a sufficient time has elapsed for the effect of the first to pass away. Better results are commonly obtained by the frequent use of very small doses, than by larger ones at longer intervals. For an average child of one year, five minims of paregoric, one fourth minim of the deodorized tincture, or one fourth grain of Dover's powder, may be used as an initial dose, to be repeated every one, two, or four hours, according to the effect produced. In some cases excellent results are obtained by the use of morphine hypodermically; to a child of one year $\frac{1}{100}$ grain may be given, and the dose repeated in an hour if no effect is seen.

Stimulants are required in the majority of the severe cases. The prostration is great and develops rapidly; frequently almost no food can be assimilated for twenty-four or thirty-six hours, while the drain from the discharges continues. The general condition of the patient is the best guide as to the time for stimulation and the amount given. Usually stimulants are not begun early enough. Old brandy is the best preparation for general use, champagne possibly being preferred for older children when the stomach is very irritable. An infant a year old will, under most circumstances, take from half an ounce to an ounce of brandy in twenty-four hours. Stimulants should always be diluted with at least six parts of water, and should be given cold, preferably in small quantities, at short intervals. If they are not retained when given by the mouth, they may be used hypodermically.

In cases of extreme prostration, the hot bath, mustard to the extremities, and sometimes the mustard pack, are beneficial. Where the drain is rapid and very great, and in all cases approaching the cholera-infantum type, subcutaneous saline injections should be used, in the manner described under Cholera Infantum.

General considerations in treatment.—(1) All severe cases must be watched very closely, especially those in infants under six months. If the temperature is rising and the passages are very fluid, one should always be apprehensive. (2) The character of the discharges is a better indication than is their number, of the patient's condition and of the effect of any plan of treatment. (3) Nothing is more simple than to give opium enough to reduce the number of passages; but unless there is some other sign of improvement, very little good, and probably much harm, has been done. (4) We must treat the patient, and not direct all our thought to acid or alkaline stools, ptomaines, or bacteria. The value of every therapeutic measure is to be estimated by its effect upon the patient's general condition. (5) No matter how strongly we may be convinced of the value of any drug or combination of drugs, if they continue to disturb the stomach they are worse than useless. (6) Both the mother and nurse must be impressed by the fact that the diet is an important part of the treatment, and that foods need to be given just as carefully as drugs. (7) In the management of any single case the important thing is prompt and thorough evacuation of the stomach and bowels, then rest for these organs for from twelve to twenty-four hours, or, as some one has tersely put it, "bold starvation"; but it is necessary in all cases that water be given freely. No cases do worse than those in which the mother or nurse in charge can not be made to appreciate the value of starvation, but insists upon giving food, especially milk, in violation of the rules laid down. (8) Great care is required during convalescence, and in fact during the remainder of the summer, to prevent relapses; these usually occur from errors in diet, particularly during days of excessive heat.

CHOLERA INFANTUM.—In comparison with the class of cases just considered, cholera infantum is rare. The term should be restricted to cases of genuine choleriform diarrhœa. Much confusion has arisen from adopting this as a generic name for all cases of summer diarrhœa. There is no other form of diarrhœal disease in which the evidence of infectious origin is so strong. Its resemblance to Asiatic cholera is striking. Its close connection with the feeding of impure cow's milk is well established. The symptoms are essentially toxic, and are due to the effect of the poison upon the heart, the nerve-centres, and the vaso-motor nerves of the intestine. The secondary symptoms depend upon the abstraction of fluid.

Cholera infantum may occur in an infant previously healthy, but this is very rare. As a rule, there is some antecedent intestinal disorder. It may be a mild diarrhœa of a few days' or even weeks' duration, or it may supervene in the course of a subacute ileo-colitis with such severity as to carry off the patient in a few hours. The development of the choleriform symptoms in all cases is very rapid, and a child, who perhaps has been regarded as scarcely ill enough to require a physician, may be brought, in the course of five or six hours, to death's door.

Usually there are general symptoms—prostration, and a steadily rising temperature—for a few hours before the vomiting and purging begin, or these may be the first things to excite alarm. Vomiting may precede diarrhœa, or both may begin simultaneously. The vomiting is very frequent. First, whatever food is in the stomach is vomited, then serum and mucus, and finally bilious matter. If it subsides for a time, it is almost sure to begin anew by the taking of food or drink. The stools are frequent, large, and fluid, and in the course of half a day, twelve or fifteen may occur. If less frequent they are proportionately larger. They are of a pale green, yellow, or brownish colour in the beginning, but as they become more frequent they often lose all colour and are almost entirely serous. The sphincter is sometimes so relaxed that small evacuations occur every few minutes. The first stools are usually acid, later they are neutral, and when serous they may be alkaline. In most cases they are odourless; in rare instances they are exceedingly offensive, at times the odour being overpowering. Microscopically the stools show large numbers of epithelial cells, some round cells, and immense numbers of bacteria.

Loss of weight is more rapid than in any other pathological condition in childhood. Baginsky records a case in which it reached three pounds in two days. The fontanel is depressed, and in rare instances there may be overlapping of the cranial bones. The general prostration is great almost from the outset. The face, better, perhaps, than any single symptom, indicates what a profound impression has been made upon the system. The eyes are sunken, the features sharpened, the angles of the mouth drawn down, and a peculiar pallor with an expression of anxiety overspreads the whole countenance. In the early stages the nervous symptoms are those of irritation: children cry loudly or moan, and throw themselves fretfully about in their cribs, the excitement sometimes bordering upon an active delirium. Later, these symptoms give place to dulness, stupor, relaxation, and coma or convulsions.

The temperature, in my experience, has been invariably elevated, and usually in proportion to the severity of the attack. In cases recovering, it has generally been from 102° to 103° F., while in fatal cases it has risen almost at once to 104° or 105° F., and often shortly before death it has reached 106° or even 108° F. Such a rectal temperature often occurs with a clammy skin and cold extremities, and is discovered only by the thermometer. Many writers speak of subnormal temperature in the later stages, but such has not been my experience. The pulse is always rapid, and very soon it becomes weak, often irregular, and finally almost imperceptible. The respiration is irregular and frequent, and may be stertorous. The tongue is generally coated, but soon becomes dry and red, and is often protruded. The abdomen is generally soft and sunken. There is almost insatiable thirst. Everything in the shape of fluids, especially ice-water, is drunk with avidity, even though vomited as soon as it is swallowed. Very little urine is passed, sometimes none at all for twenty-four hours; yet this need give no special concern, as it depends upon the great loss of fluid by the bowels.

Symptoms such as those described rarely continue more than one day without a decided change either for better or worse. In the fatal cases there are hyperpyrexia, cold, clammy skin, absence of radial pulse, stupor, coma or convulsions, and death. The diarrhœa and vomiting may continue until the end, or both may entirely cease for some hours before it occurs. The patients may pass into a condition resembling the algid stage of epidemic cholera, with pinched, sunken features, subnormal temperature, dyspnœa, and cool breath, and may die in collapse. In other cases, after the first day of very severe symptoms, the discharges diminish, but the nervous symptoms become specially prominent. There are restlessness and irritability or apathy and stupor. The fontanel is sunken; the eyes are half open and covered with a mucous film; respiration is irregular and superficial, sometimes even Cheyne-Stokes; the pulse is feeble, irregular, or intermittent; the extremities are cold; the muscles of the neck drawn back; the abdomen retracted; no desire for food is shown, the patient rousing only from thirst. The temperature is not elevated, but normal or subnormal. From this condition recovery may take place with gradual abatement of the nervous symptoms, improved pulse and circulation, the stools gradually becoming more consistent and having more colour; or the symptoms may merge into those of ileo-colitis. Much more frequent than either of the foregoing, is the fatal termination.

These nervous symptoms described were grouped by the earlier writers, first by Marshall Hall, under the term *spurious hydrocephalus*, or *hydrencephaloid*. They have been variously explained by different writers as due to cerebral anæmia, cerebral hyperæmia (venous), œdema of the meninges, thrombosis of the cerebral sinuses, and uræmia. In but a single instance have I met with post-mortem changes in the brain which bore any proper relation to the symptoms.* Although I have examined the brain in almost all my autopsies upon patients dying from diarrhœal diseases, I have never in such cases seen sinus thrombosis, and but rarely œdema. Cerebral hyperæmia was often met with in cases dying in convulsions, but not with any regularity otherwise. Nor have my observations upon the kidneys confirmed the observations of Kjellberg, whom most of the writers since his day have quoted, as to the great frequency of nephritis. Albumin, casts and renal epithelium in the urine are rare, and blood I have never seen. The kidneys at autopsy are found generally paler than normal, with a moderate cloudy swelling of the cortex, but not more than in other febrile disorders of infancy. These facts forbid our regarding either the renal or the cerebral changes as an explanation of the nervous symptoms of most of these cases; they seem rather to depend upon acute inanition and intestinal toxæmia.

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* In this infant the cerebral symptoms were so marked and so characteristic that two excellent physicians who watched the case, unhesitatingly made a diagnosis of meningitis. The intestinal symptoms were considered of secondary importance. The autopsy revealed follicular ulcers of the ileum, moderate parenchymatous nephritis, and an extreme degree of cerebral anæmia.

In cases going on to recovery the vomiting usually ceases first; then the stools become less frequent, contain more solid matter, and have more colour. Improvement in the pulse, a fall in the temperature, and subsidence of the nervous symptoms soon follow. The disappearance of the nervous symptoms is always to be regarded as a very favourable sign. The discharges gradually assume more and more of the character of a catarrhal diarrhœa, which continues a week or more. Convalescence is never very rapid. Sometimes, after all signs of improvement have continued for two or three days, the choleraic discharges return with great severity, and the case proves fatal.

An infrequent complication of cholera infantum is sclerema. This condition is found associated with muscular contractions, subnormal temperature, and other signs of the most extreme depression. These cases are invariably fatal.

Diagnosis.—Cholera infantum can scarcely be mistaken for any other form of intestinal disease if its chief symptoms are kept in mind—constant vomiting, profuse serous stools, great thirst, dry tongue, high temperature, and great restlessness, followed by rapidly developing collapse, sunken fontanel, pinched, anxious face, cold extremities, weak pulse, dyspnœa, cyanosis, stupor, coma, and death.

Prognosis.—The prognosis is worse in a very young infant, in one who has been badly fed and poorly cared for, when all the surroundings are unfavourable, when the patient has suffered from antecedent disease, and in midsummer. Yet fatal cases are often seen in infants previously healthy and living in good surroundings. There are cases in which it is evident, from the first few hours of the attack, that death will be the issue. The physician is never warranted in telling parents that the result would have been different had he been called in time. No matter what treatment is employed, the vast majority of the very severe cases terminate fatally. Of the cases of true cholera infantum which have come under my notice during the last ten years, fully two thirds have died. The result depends more upon the severity of the attack than upon anything else.

Treatment.—Restricting the term to the class of cases described above, all who have seen much of the disease must admit that the results of treatment are extremely unsatisfactory, and that the most severe cases pursue their course but little, if at all, influenced by the treatment employed. This statement is made after personal trial of almost every method of treatment which has been advocated by writers upon the subject.

In the way of prophylaxis much can be done. All the general rules of prevention laid down in the previous chapter should be enforced here. Special emphasis, however, is to be laid upon the early treatment of the milder intestinal derangements, since it is a rule, to which the exceptions are few, that such symptoms precede for some days the occurrence of the choleriform diarrhœa. No case of diarrhœa in summer is to be neglected on the score of existing dentition. It is also important in convalescence from ileo-colitis that vigilance should never be relaxed until the stools are normal. One frequently sees cases which, so far as it is possible to judge, had been progressing steadily toward recovery, cut off in a day by the development of cholera infantum.

The best view of the treatment will be gained if we keep in mind that we are not treating intestinal catarrh, nor intestinal inflammation, although this may ensue, but that these are essentially cases of poisoning; that the toxic materials act by causing great depression of the heart and the system generally by acting on the nerve-centres, and by paralysis of the vaso-motor nerves of the intestines.

The main indications are: (1) to empty the stomach and intestine; (2) to neutralize the effect of the poison upon the heart and nervous system; (3) to supply fluid to the blood to make up for the very great drain of the discharges; (4) to reduce the temperature; (5) to treat special symptoms as they arise.

For the first indication we must rely upon mechanical means—stomach-washing and intestinal irrigation—for there is no time to wait for the action of cathartics. For the second, nothing in my hands has proved so useful as the hypodermic use of morphine and atropine. I believe this to be more efficient than any other means of treatment we possess. Morphine is contra-indicated where the purging has ceased or is slight, and where there is drowsiness, stupor, or relaxation. The effects of the dose should always be carefully watched; a small dose repeated is better than a single large dose. For a child a year old, not more than gr. $\frac{1}{100}$ of morphine and gr. $\frac{1}{800}$ of atropine should be the initial dose. It may be repeated every hour until the desired effects are produced: these are, arrest of the vomiting and purging (or at least their diminution), improvement in the heart's action, and in the nervous symptoms. Here, as in shock, we find morphine our most reliable heart stimulant. The use of opium by the mouth is not to be relied upon, owing to the uncertainty of absorption and the liability to produce vomiting.

For the third indication, it is useless to give fluids by the mouth. The only thing that can be depended upon is the injection into the cellular tissue of a saline solution (common salt forty-five grains, sterilized water one pint). This may be injected into the cellular tissue of the abdomen, buttocks, thighs, or back. To be efficient at least half a pint should be given in the course of every twelve hours. A very much larger quantity can often be used with advantage. This causes no irritation, and is absorbed with surprising rapidity. A simple apparatus for making the injection has been devised by Dawbarn, viz., to attach the needle of a hypodermic syringe by a few inches of rubber tubing, to the nozzle of a bulb (Davidson's) syringe. It must be tied securely. Only a sterilized syringe should be used, and care must be taken to prevent the entrance of air. The injection is made slowly, and the exact amount introduced at each time, measured.

Only baths are to be relied upon for the reduction of temperature. The graduated bath should be used, as described on page 48. It may be continued from ten to thirty minutes. To be efficient, it must be used frequently—as often as every hour if symptoms are threatening. Iced cloths or an ice cap should be applied to the head. Ice-water injections are a valuable accessory to the treatment by baths. A rectal tube should be used, and the injection carried high up into the colon, the water being allowed to flow in and out freely. Nothing should be allowed by the mouth except ice and iced champagne or brandy. The stimulants must be given in small quantities and frequently. When stimulants taken by the mouth are vomited, they should be given hypodermically. Brandy, ether, or camphor may be employed, and used freely. During the stage of most acute symptoms, to attempt to give food or drugs of any kind by the mouth is worse than useless. After the stage of violent symptoms has subsided and reaction is established, the subsequent management in respect to feeding and medication should be the same as in the cases considered in the previous chapter. If the symptoms described as *hydrencephaloid* are present, opium is to be avoided, stimulants by the mouth used freely, and, if these are not retained, they should be given hypodermically. For cold extremities and subnormal temperature, hot mustard baths should be used to establish reaction, mustard paste applied all over the body, and hot-water bags and bottles placed about the patient.

CHAPTER VIII.

DISEASES OF THE INTESTINES.—(Continued.)

ACUTE COLITIS AND ILEO-COLITIS.

Synonyms: Entero-colitis, enteritis, enteritis follicularis, dysentery, inflammatory diarrhœa.

THE terms *colitis* and *ileo-colitis* are general ones, embracing those forms of intestinal disease in which there are found more serious lesions than those of the superficial epithelium, which occur in acute gastro-enteric infection. By separating these two groups of cases it is not meant to imply that cases of ileo-colitis are not infectious; but in gastro-enteric infection recovery or death takes place before anything more than superficial changes have occurred, while in the ileo-colitis the pathological process continues until there have been produced marked lesions, often involving all the walls of the intestine. Ileo-colitis is thus to be regarded as a condition in which any case of gastro-enteric infection may terminate. Sometimes the transition is so gradual that it is impossible, by symptoms, to draw a line between them. This is especially true of the cases terminating in follicular ulceration of the colon. In some of the other forms—acute catarrhal and acute membranous colitis—the evidences of a severe intestinal inflammation are often manifest from the very outset. This difference is probably due to the character of the infection and its virulence in the two classes of cases. The extent of the lesions depends very much upon the duration of the process. It has seemed wise, with our present understanding of these cases, to drop the term *dysentery* as a generic one, grouping them all under the general head of ileo-colitis until an etiological classification shall become possible.

Etiology.—Most of the etiological factors discussed in the previous chapter apply with equal force to the cases of ileo-colitis. It may be secondary to any of the infectious diseases, particularly measles, diphtheria, and broncho-pneumonia. Epidemics of ileo-colitis, in the true sense of the term, I have never seen. As to contagion, we are still in doubt as to the degree in which this is possible. Infants are most often affected, but the disease is not uncommon up to the fifth year. Attacks are more frequent in the summer, but they may occur at any season of the year. They are often seen in the fall months, when outbreaks sometimes seem to be very closely connected with marked changes in the temperature.

But little is as yet definitely known regarding the nature of the infection in cases of ileo-colitis. Booker found that the deeper lesions were almost invariably associated with the presence of streptococci, but whether they are primary or secondary is not easy to determine. What part the amœba coli plays in the colitis of infancy and early childhood it is now impossible to say. Amœbæ have been found by Cahen and others in the stools of typical cases, but thus far too few observations have been made to admit of any deductions.

Lesions.—The nature of the lesions in ileo-colitis differs very much in the different groups of cases, but their position is quite constant: they affect the lower ileum and the colon. In about half the cases only the colon is affected. The lesions of the ileum are frequently limited to its lower two or three feet.

The frequency with which the different varieties of ileo-colitis were found in eighty-two of my own autopsies was as follows:

Follicular ulceration	36
Catarrhal inflammation	26
Catarrhal ulceration	6
Membranous inflammation	14
	82

Acute catarrhal ileo-colitis.—In the milder cases there are changes in the epithelium and infiltration of the mucosa. In the severe cases the submucosa is involved, and the infiltration of the mucosa may be so great as to lead to necrosis and the formation of catarrhal ulcers.

Gross appearances.—While the lower ileum and the colon are most seriously affected, it is not uncommon to find quite marked changes in a considerable portion of the small intestine, and even in the stomach. In the cases of short duration, the lesions are sometimes more marked in the small intestine than in the colon. The stomach contains undigested food, and mucus which is commonly stained a dark-brown colour. It may be dilated or contracted. The mucous membrane is pale or congested; if the latter, it is usually in patches, and more about the pyloric orifice. The intestinal contents are generally green in colour, and thin. The mucous membrane is often coated with tenacious mucus. The small intestine is distended with gas, the large intestine nearly empty, except the transverse colon. The mucous membrane may appear somewhat swollen. In the small intestine there are occasionally seen swelling and œdema of the villi, so that they project abnormally and give a plush-like appearance. Congestion is a constant feature, and it may be simply upon the folds of the mucous membrane, or about the solitary lymph nodules; or it may be intense and involve the whole intestine for some distance. Small hæmorrhagic areas are often seen here and there, widely scattered. In the most severe cases there are marked thickening and uniform congestion, and the appearance is sometimes much like that seen in membranous inflammation. The

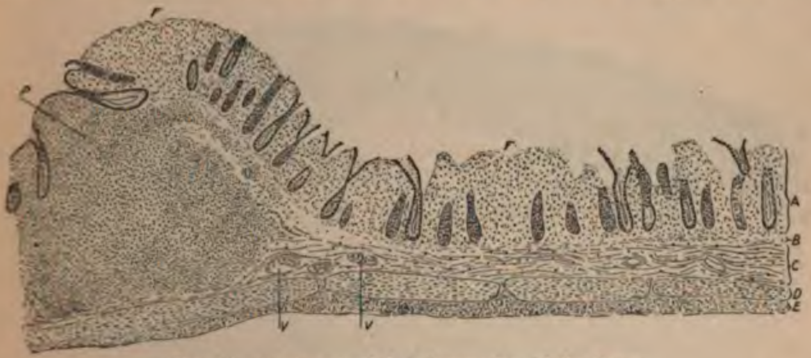


FIG. 52.—Acute catarrhal inflammation of the ileum.

At the left is seen the edge of a Peyer's patch (*P*) greatly swollen. The most striking feature of the lesion is the loss of the superficial epithelium, which is shown in all parts of the specimen. The significance of this depends upon the fact that the autopsy was made but two hours after death. At several points, *F*, *F*, the tubular follicles have loosened and fallen out. The mucosa, *A*, is slightly infiltrated with cells, especially near the Peyer's patch. The submucosa, *C*, and muscular coats, *D*, *E*, are normal. *V*, *V*, are small veins. *History.*—Infant, nine months old, previously healthy; sick three days with severe intestinal symptoms; temperature. 103° to 105° F. *Autopsy.*—Acute catarrhal inflammation of ileum and colon; Peyer's patches red and swollen. The specimen is taken from the lower ileum. The superficial character of the lesion is chiefly due to the short duration of the process.

lymph nodules (solitary follicles) throughout the colon are usually swollen, projecting above the mucous membrane about the size of a pin's head. Peyer's patches may be normal, or they may be swollen and congested, with other evidences of catarrhal inflammation in the surrounding mucous membrane, or more rarely they may be involved when the rest of the mucosa appears healthy. The same is true of the lymph nodules of the small intestine. The lymph nodes of the mesentery are usually swollen and acutely congested, but they may appear normal.

Microscopical appearances.—In interpreting the changes found in the mucosa, the same precautions must be observed as stated on page 320.

There is usually loss of the superficial epithelium and of that lining the tubular glands at their orifices. Upon the surface of the mucosa and within the tubular glands, fine granular matter is seen from the broken-down epithelium. The goblet cells are distended with mucus, and do not stain clearly. The lumen of the tubular glands is narrowed from pressure due to the swelling of the lymphoid tissue which separates them, which is partly from œdema, and partly from cell infiltration (Fig. 52). Entire tubular glands may loosen and fall out. A thick layer of mucus and round cells, adhering closely to the surface, may resemble pseudo-membrane (Fig. 53). In the milder varieties the infiltration with round cells is not great and is usually limited to the mucosa, the extent depending principally upon the duration of the process. In the very severe cases

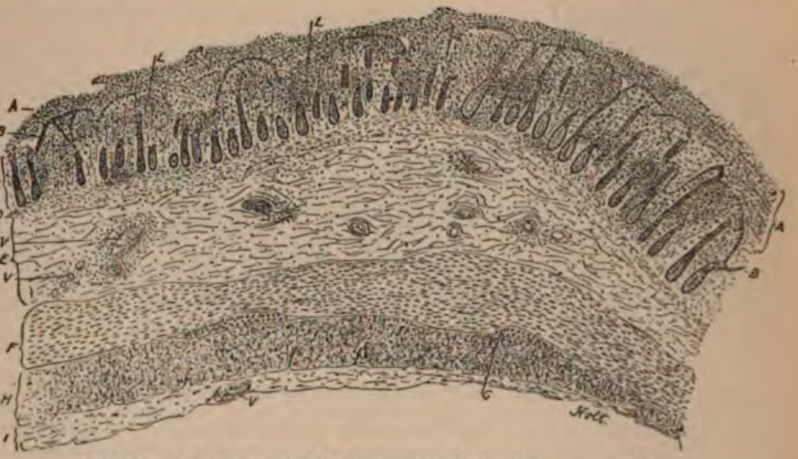
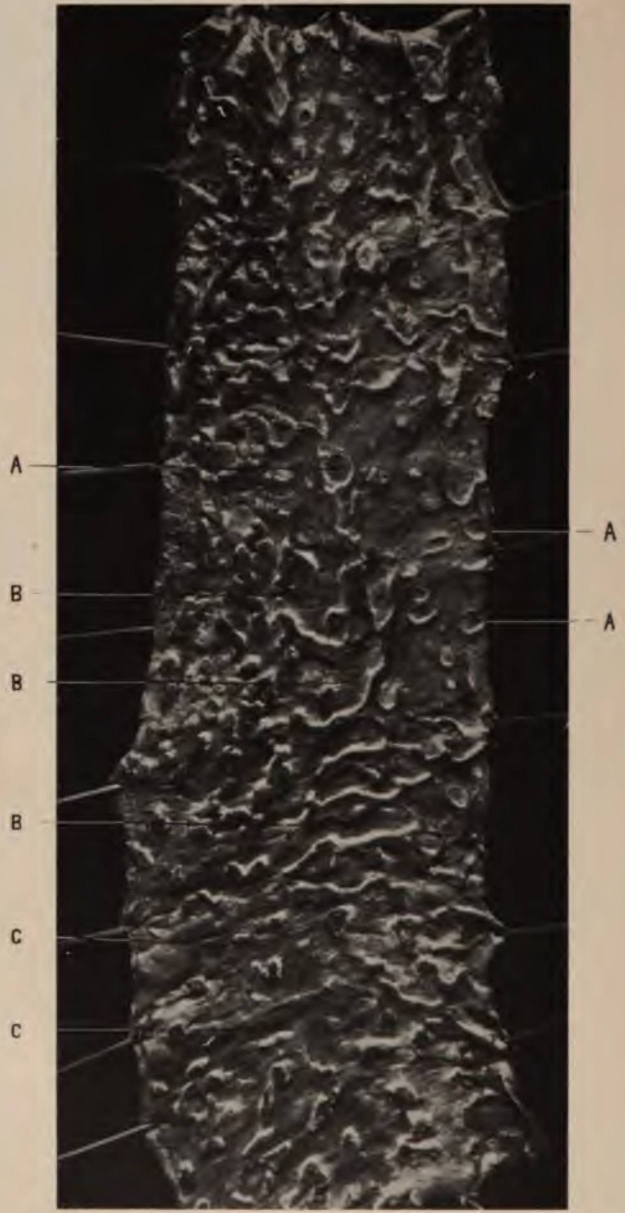


FIG. 53.—Acute catarrhal inflammation of the ileum; severe form.

The mucosa, *C*, is everywhere densely infiltrated with round cells, compressing the tubular follicles, and in places, *L*, *L*, almost effacing them. Upon the surface of the mucosa is a thick layer of cells and mucus. Beneath this the epithelial arches, *B*, *B*, covering the villi can be seen. The lesions are almost entirely of the mucosa. The only changes in the submucosa, *E*, are groups of cells about the small blood-vessels, *V*, *V*. *History*.—Infant six months old; moderate diarrhœa twelve days; severe symptoms with high temperature for six days. There was intense inflammation of the entire colon and lower three feet of the ileum. Intestine greatly congested and thickened. Specimen is from the ileum.

PLATE VIII



Extensive Catarrhal Ulceration of the Colon.

Female child nine months old; symptoms of acute ileo-colitis of fifteen days'
tion; temperature, 101° to 104·5° F., and from six to eight stools daily—thin,
and yellow, but no blood.

Extensive ulceration throughout the colon, most marked in descending po
from which specimen is taken.

A A are small circular ulcers; B B, larger ones from coalescence of seve
these; C C, large areas of ulceration, the mucous membrane being almost en
destroyed.

there is found a dense infiltration of the mucosa and of the submucosa also, which in places extends quite to the muscular coat. These cases closely resemble those of the membranous variety, lacking only the exudation of fibrin. The lymph nodules of the colon are swollen to a greater or less degree, chiefly from an increase in the number of lymphoid cells. This swelling may be the most prominent feature of the lesion. If the process is sufficiently prolonged, the lymph nodules may break down and ulcerate. The changes in the lymph nodules of the small intestine and in Peyer's patches are similar to those seen in the colon, but are less marked, and frequently absent altogether. Ulceration in Peyer's patches is extremely rare.

The small veins and capillaries of the submucosa and mucosa are usually distended with blood; small extravasations are very common, and occasionally larger ones are seen.

Catarrhal inflammation, except in its very severe form, which is not frequent, causes no lesions that can not readily be repaired. The most persistent change is usually the swelling of the lymph nodules, which may last a long time, and appears to be an important factor in the tendency to relapses and recurring attacks. If there is a continuance of the exciting cause, or the patient's constitution is a bad one, the process may become chronic.

Catarrhal ulceration.—In the most severe form of catarrhal inflammation which does not prove fatal in the earlier stages, extensive ulceration occasionally takes place; usually these ulcers are seen throughout the entire colon, and, in rare cases, a few are found in the lower ileum. They generally begin in the mucosa overlying the lymph nodules, and while they have a wide superficial area, they do not extend deeper than the mucosa. The small ulcers are circular and usually show at the centre a small granular body—the lymph nodule. The larger ulcers result from the coalescence of several small ones, and are irregular in shape. They may be two or three inches in diameter. Sometimes for a considerable distance a large part of the mucosa may be destroyed. Often the entire surface presents a worm-eaten appearance (Plate VIII). On microscopical examination there is seen, in the greater part of the ulcer, complete destruction of the mucosa, the submucosa being densely packed with round cells quite to the muscular coat.

Inflammation of the lymph nodules with ulceration (*follicular ulceration*).—Follicular ulcers are found at autopsy in about one third of the cases dying from diarrhœal diseases. They are rarely seen in those which have lasted less than a week, and not often before the middle of the second week; the average duration of the cases being about two and a half weeks.

In thirty-six cases in which follicular ulcers were found at autopsy, they were present in the small intestine alone in but three cases; in the small intestine and in the colon in six cases; in the remaining twenty-seven they were present only in the colon. When in the small intestine they were seen only in the lower ileum. Ulceration was seen a few times in one or two of the nodules of a Peyer's patch. Ulceration of the large intestine involved the whole colon in about half the cases; while in the remainder the process was limited to its lower portion. The deepest and also the largest ulcers were usually in the descending colon and sigmoid flexure.

In the early stage these ulcers appear as tiny excavations at the summit of the prominent lymph nodules. Later, the whole nodule may be destroyed, and a small round ulcer is formed from one twelfth to one fourth of an inch in diameter (Plate IX). These are quite deep and have overhanging edges; when closely set they give the intestine a sieve-like appearance. By the coalescence of several of them, larger ulcers may form which are an inch or more in diameter. At the bottom of these larger ones the transverse striæ of the circular muscular coat are often plainly seen. I have never known them to cause perforation.

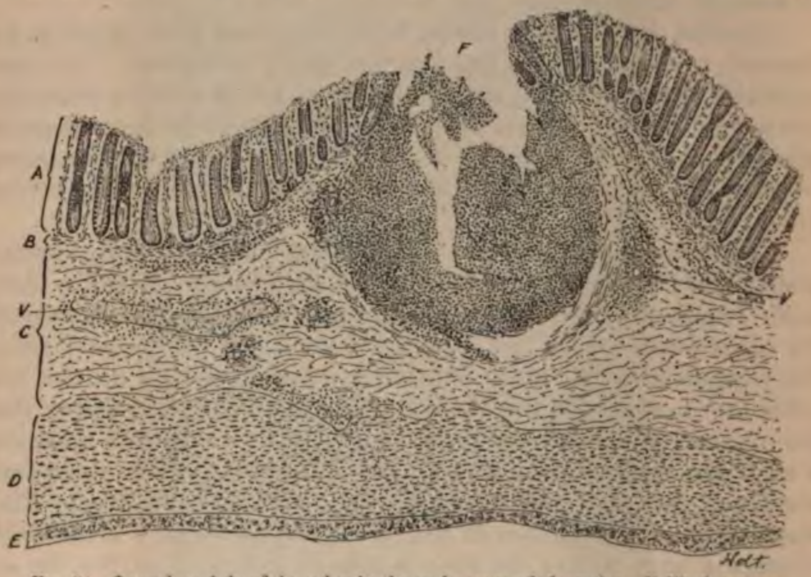
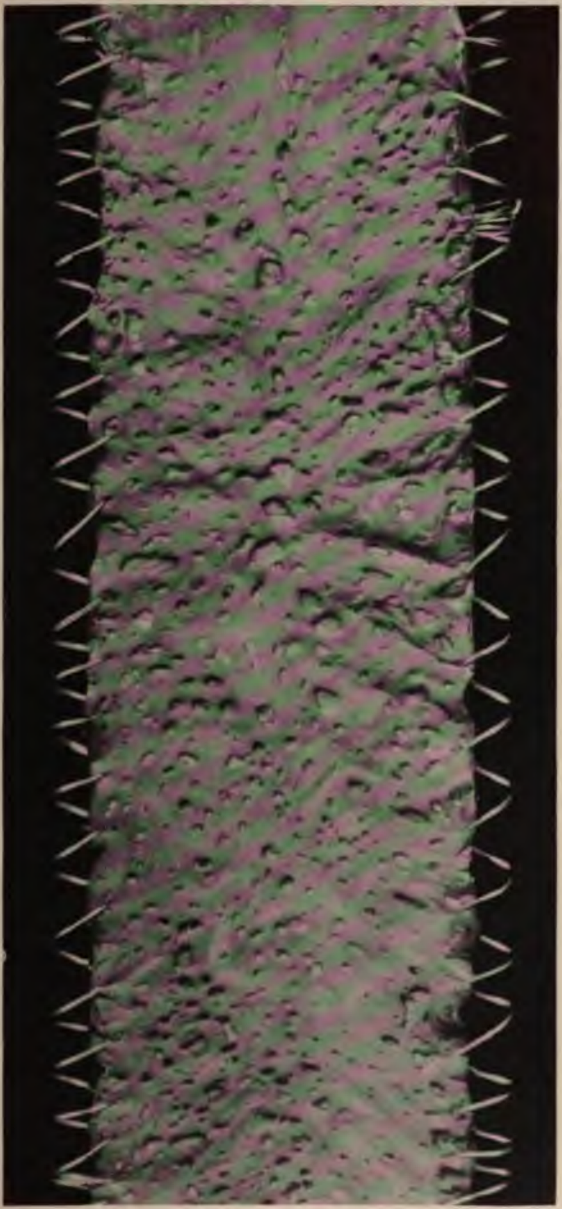


FIG. 54.—Lymph nodule of the colon in the early stage of ulceration—Follicular ulcer.

The nodule, *F*, is much enlarged, and is breaking down and discharging into the intestine The other changes are not marked. The superficial epithelium is gone; the mucosa, *A*, shows a slight increase of cells, and in the submucosa, *C*, are nests of cells about the small vessels, *V*, *V*. *History.*—Delicate child, thirteen months old; slight diarrhœa four weeks; severe symptoms five days. The colon was filled with ulcers one twelfth of an inch in diameter, one of which is shown in the illustration.

Microscopical appearances.—The lymph nodules are swollen, principally from the accumulation within them of round cells. This is followed by softening, which usually begins at the summit of the nodule and ex-

PLATE IX.



Deep Follicular Ulcers of the Colon.

A delicate child, fourteen months old, sick twelve days; stools green, yellow, brown, and watery; no blood; temperature, 100° to 101° F.

The small intestine was normal; ulcers throughout colon. The specimen is from descending colon; the ulcers are deep, and most of them extend to the muscular coat. (For microscopical appearance, see Fig. 55.)

tends downward; the reticulum breaks down, and the cellular contents escape into the intestine (Fig. 54). Softening may begin at the centre of the nodule, which ruptures like an abscess. The destruction of the whole nodule leaves a cavity, which is the follicular ulcer. At first the ulcers correspond in size to the nodule, but meanwhile infiltration of the adjacent tissue has taken place, and this may become necrotic. In this way the ulcer extends, chiefly in the submucous coat. The lesion is never limited to the lymph nodules; but the extent of the other changes found, depends upon the severity and the duration of the process. In cases dying after an illness of a week or ten days, we usually find only moderate changes in the mucosa, and in the submucosa a slight infiltration of round cells, especially about the small blood-vessels (Fig. 54, *V*, *V*). In those which have lasted three or four weeks the ulcers are deeper, and all the structures of the intestine in their neighbourhood, are usually involved (Fig. 55). The mucosa is densely packed with round cells, as are also all the tissues in the vicinity of the ulcers; even the muscular coat may be infiltrated. The ulcers, however, rarely extend deeper than the circular layer.

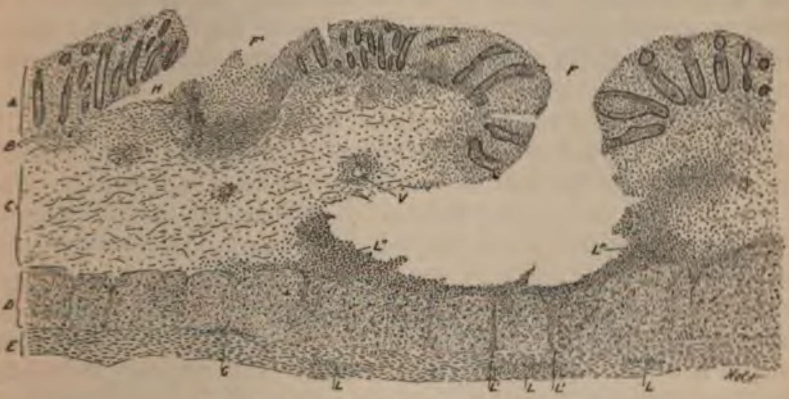


Fig. 55.—Deep follicular ulcer of the colon.

A deep ulcer is shown at *F*, a smaller one at *F'*. The separation of the mucosa at *H* is accidental. There is no trace of the lymph nodule from which the large ulcer had its origin. The destructive process has extended laterally in the submucosa, *C*, and the mucosa, *A*, is falling in to fill up the space. In the vicinity of the ulcers, the submucosa is densely infiltrated with round cells, *L''*, *L''*, which also are seen in the lymph spaces between the bundles of circular muscular fibres, *L'*, *L'*, and some are seen in the longitudinal muscular coat, *L*, *L*. *History.*—Thirteen months old, delicate; continuous diarrhœal symptoms for three weeks. Ulcers found throughout the colon, the largest, one half an inch in diameter. The illustration shows one of the small ones like those in Plate IX.

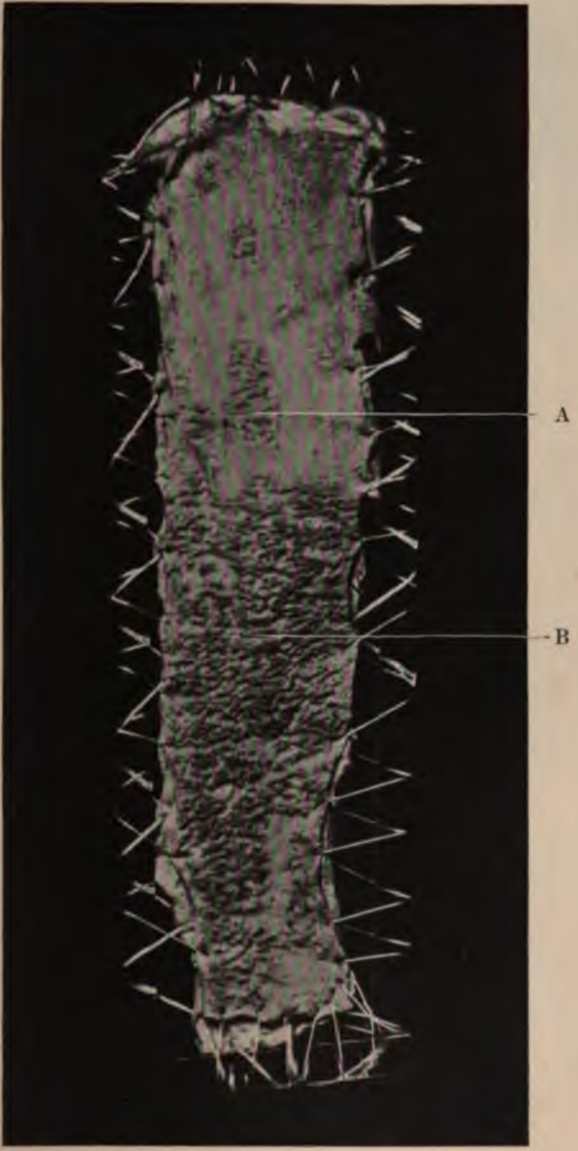
Follicular ulceration of the intestine in infancy, usually terminates fatally if the process is an extensive one. In less severe cases, recovery may take place, the ulcers healing by granulation and cicatrization in the course of from four to eight weeks.

Acute membranous ileo-colitis.—This is the most severe form of intestinal inflammation seen among children. The process differs quite materially from that described as occurring among adults. In only one of my own cases was it associated with membranous inflammation of any other mucous membrane, in that case with membranous gastritis. A specimen was presented to the New York Pathological Society in 1889 by Sellew, in which this lesion was associated with a membranous inflammation of the pharynx. Membranous colitis usually runs a short, intense course, with a temperature which continues moderately high, severe constitutional symptoms, and death generally in eight or ten days. The shortest case I have seen lasted six days. If recovery takes place it is only after a very prolonged illness.

Gross appearances.—There is visible to the naked eye usually very little pseudo-membrane and no deep sloughing. The lesion affects with remarkable uniformity the last two or three feet of the ileum and the entire colon. It is exceedingly rare to meet with any marked lesions high in the small intestine. The most marked changes are near the ileo-cæcal valve or in the sigmoid flexure and the rectum. In the ileum they are usually quite as severe as in the colon (Plate X). The intestinal wall is firm and stiff, and is two or three times its normal thickness. It is not thrown into deep folds, as is the healthy intestine when empty. It is very rare to find false membrane that can be stripped off in patches of any considerable size. Where membrane exists, the colour is a grayish green, and the surface is often fissured, giving a lobulated appearance. In the parts where no pseudo-membrane can be seen, the surface is usually of an intense red colour and is rough and granular, in striking contrast to the normal glistening appearance. Here and there small extravasations of blood may be seen. In the regions most affected, the normal structures of the mucous membrane—the villi, Peyer's patches, and solitary follicles—can not be distinguished. Although the whole colon is diseased, the lesions differ very much in severity in the different regions, and large areas of pseudo-membrane are rare. In a single instance I found an exudation of fibrin on the peritoneal surface of the intestine for a short distance. Except in the lower ileum the small intestine shows no constant changes, and none are usually found in the stomach.

Microscopical changes.—These (Fig. 56) are much more uniform than the gross appearances. The most characteristic feature is the exudation of fibrin, which forms a distinct pseudo-membrane upon the surface of the intestine, and may infiltrate the mucosa, and even the submucosa. Fibrin is found under the microscope in parts of the specimen, which to the naked eye shows no distinct pseudo-membrane, but only a granular appearance. In rare cases a fibrinous exudation may be found upon the peritoneal covering of the intestine. The pseudo-membrane is made up of a fibrinous network containing small round cells, some red blood-cells, and bacteria, chiefly cocci. The mucosa, and usually the submucosa, are

PLATE X.



MEMBRANOUS INFLAMMATION OF THE ILEUM.

A delicate child, eleven months old; mild diarrhœa for two weeks without fever; acute severe symptoms for twelve days; temperature, 100° to 102·5° F.; green and mucous stools; no blood.

The lesions involved the last foot of ileum and entire colon. Specimen is from lower ileum, and shows the abrupt termination of the lesion; the upper part shows normal small intestine; A is a Peyer's patch; B is the inflamed part of the intestine; it has a rough granular appearance and is much thickened.

densely infiltrated with small round cells, which in places may be so numerous as to efface the normal elements of the intestine. The tubular follicles are in some places quite destroyed, not a vestige of them remaining. In other places they are compressed and distorted by the accumulation of cells. The great thickening of the intestine is due partly to the cell infiltration, partly to the fibrinous exudation, and partly to œdema. All the blood-vessels, both in the mucosa and submucosa, are gorged with blood, and many small extravasations are seen. A necrotic process with the formation of deep ulcers I have never seen associated with membranous colitis.

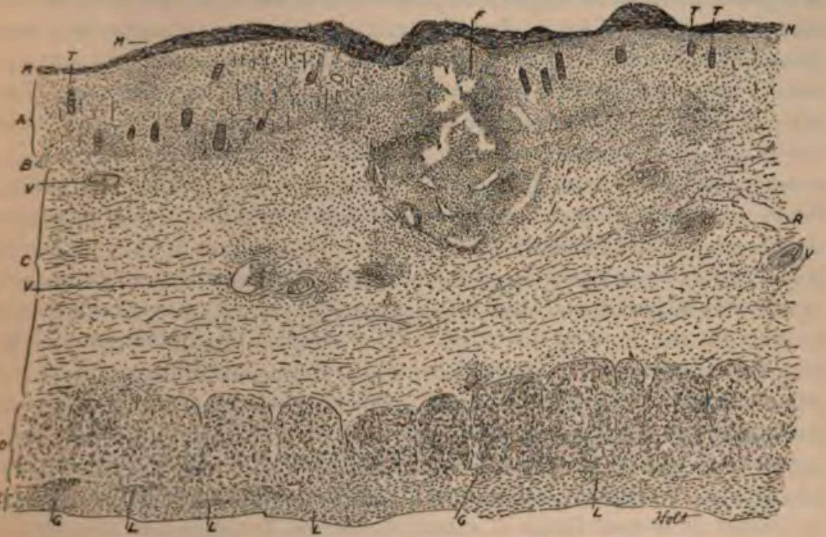


Fig. 56.—Membranous inflammation of the colon.

The intestine is covered with a pseudo-membrane, *M*, which is composed chiefly of granular fibrin; the mucosa, *A*, is densely packed with round cells, and the tubular follicles have almost disappeared, traces only being left at *T*, *T*. The submucosa, *C*, is greatly thickened, partly from cells, but chiefly from fibrin, which with a high power is seen to be everywhere in this coat, as well as the mucosa. Nests of cells are seen in the muscular coats at *L*, *L*. At *F* is a lymph nodule covered by pseudo-membrane, but breaking down at its centre. *V*, *V*, are small blood-vessels with nests of cells about them. *History.*—Fourteen months old; ill nine days; temperature 101° to 105° F.; all stools containing blood. Lesions found throughout colon and in lower ileum. Intestine greatly thickened. Specimen is from ascending colon, where lesion was especially severe.

Associated lesions of ileo-colitis.—The most important one is bronchopneumonia. It is found in quite a large proportion of the protracted cases, and not infrequently it is the cause of death. I once saw a pulmonary abscess complicating ulcerative colitis. It was at the apex, and was not associated with abscesses elsewhere in the body. Bronchitis is a very common complication. Peritonitis is rare, and when present is usually circumscribed and of the plastic variety. Acute degeneration of the epithelium of the kidney (cloudy swelling) is very common, and in fact it is usually found in the cases which have been marked by high temperature. Exudative nephritis is, however, in my experience rare. There are no characteristic or uniform changes found either in the liver, spleen, heart, or brain.

Symptoms.—(1) *Catarrhal cases of moderate severity.*—The onset is usually sudden, often with vomiting, and for twelve, sometimes twenty-four, hours the symptoms may be those of acute indigestion: vomiting, pain, fever, and frequent thin green or yellow stools, which are partly fæcal and contain undigested food. Later the characteristic discharges are seen. These are composed of blood and mucus; they are preceded by pain and usually accompanied with tenesmus. The stools are very frequent, often every half hour and proportionately small, sometimes less than a tablespoonful being found upon the napkin after severe straining efforts. The mucus may be clear and jelly-like, or it may be mixed with fæcal matter. Blood is seen in almost every stool, but rarely in clots, usually streaking the mucus. Fluid blood may be present. These stools are almost odourless. After two or three days the blood usually disappears, or is seen only as traces in an occasional stool. Mucus is still present in large quantities, making up the bulk of the stool. The colour of the discharges now becomes a dark brown or a brownish-green. Prolapsus ani is frequent, and often occurs with nearly every stool. For the first twenty-four hours the temperature is usually high, from 102° to 104° F. Later, and throughout most of the attack, it ranges from 99° to 102° F. In the mildest cases it may not be above 101° F. at any time. The prostration is not so great at the outset as in most forms of intestinal disease, but increases steadily for several days. The appetite is lost for the first two or three days, but there is usually great thirst. Abdominal pain is present and is often quite intense just before the stool. In most cases there is tenderness along the colon.

The duration of the severe symptoms is usually less than a week, and even though the child was previously in good condition and properly treated, recovery is rarely rapid. The first symptom of improvement is generally the disappearance of blood from the stools, which at the same time become less frequent, and the pain and tenesmus cease. Gradually the stools assume more of a fæcal character, but mucus is likely to persist for two or three weeks; it may be seen in all stools, or only occasionally. In some cases both the mucus and blood disappear and the stools become thin, brown, or green, like those of an ordinary diarrhœa. Although the early stage of very acute symptoms may last but a few days, if there is a continuance for two or three weeks of the brown, mucous stools, with emaciation and slight fever, ulceration is probably present. This is likely to occur if the child is in poor condition, if its surroundings are bad, or if it is improperly treated at the outset. Relapses are readily excited, but cases like the above are rarely fatal except in very delicate infants. This is the most common form of ileo-colitis which terminates in recovery.

(2) *The severe catarrhal form.*—The symptoms closely resemble those of the membranous variety, and a diagnosis from it is to be made only by the absence of pseudo-membrane from the stools. The most rapid case I have seen lasted but three days, but the usual duration is from one to two weeks. The temperature is steadily high; the stools continue very frequent and contain much blood; there are great prostration, dry tongue, sordes on the lips and teeth, and prominent nervous symptoms. Death usually occurs from exhaustion and profound sepsis while the acute symptoms are at their height. If the patient survives this stage, the case may drag on for four or five weeks, very much like the one of follicular ulceration, and then terminate in recovery or in death from slow asthenia, broncho-pneumonia, or an acute exacerbation of the intestinal symptoms. The autopsy in such cases usually reveals the presence of catarrhal ulcers. If recovery is to be the outcome, after the symptoms have been nearly stationary for a long time, there is seen a gradual turn for the better, and improvement first in the general and then in the local conditions. Convalescence is very slow, often interrupted by relapses, and it may be months before the patient is quite well. In some cases the child never regains its former vigour.

(3) *Follicular ulceration—ulcerative inflammation of the lymph nodules.*—Follicular ulceration is not very often met with in infants under six months of age. Of thirty-six cases in which the diagnosis was confirmed by autopsy, all but four were between the ages of six and twenty-one months. The great majority of these children were in poor condition at the time of the attack.

To understand the symptoms of these cases, it must be remembered that follicular ulceration is the terminal process to which continued cases of acute gastro-enteric infection tend. It may be preceded by one or more acute attacks, or by a protracted subacute attack. On account of the feeble resistance of the child or the continuance of the exciting cause, the pathological process gradually extends from the epithelium to the lymph nodules of the intestine, chiefly the colon, which, as already described, pass successively through the stages of swelling, softening, and ulceration. The onset of the illness may therefore be sudden, with vomiting and high fever; or gradual, without vomiting and with very little fever. The patient may be ill for a week before the exact type which the disease is assuming can be positively determined. It is not possible to mark the transition from acute gastro-enteric infection to follicular ileocolitis. Usually the latter may be assumed to exist whenever, after one of these attacks, there is a continued temperature above 101° F., and when the stools habitually contain large quantities of mucus without blood.

Vomiting is not a feature of these cases; but it is often present at the onset. Throughout the attack it is easily excited by injudicious feeding or medication. The temperature is seldom high, except at the onset;

its usual range is from 99° to 101° F.; toward the close, even of fatal cases, it may be scarcely above the normal. The accompanying chart (Fig. 57) is a very good illustration of the course of the temperature in cases beginning abruptly and ending fatally.

The stools are not usually very frequent, the number being from four to eight a day. The most constant feature is the presence of mucus, which is mixed with the stools and usually abundant. Blood is not generally present, and a large amount of blood is extremely rare. It was absent entirely in more than half of my cases in which the diagnosis was confirmed by autopsy. A small quantity of blood early in the attack is not uncommon, depending here upon congestion. Large hæmorrhages from ulcers I have never seen. The colour of the stools is most frequently of a dark green or brown. Fluid stools are seen only during exacerbations. The odour is usually offensive, particularly in protracted cases. The microscope shows epithelial cells in great numbers, and very often an abundance of small round cells, which may be looked upon as the most constant sign of ulceration.

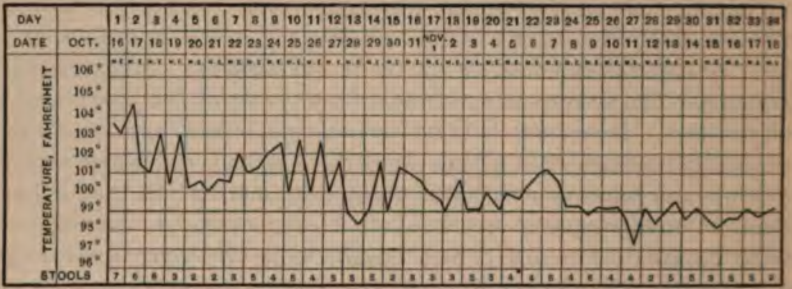


Fig. 57.—Temperature chart of ileo-colitis, fatal on thirty-fourth day. Autopsy showed follicular ulcers throughout the colon.

The failure in nutrition and steady loss in weight are very constant in these cases. As emaciation goes on, the skin hangs in loose folds on the thighs; it becomes dry and scaly and loses its elasticity, and occasionally small petechial spots are seen upon the abdomen. The skin over the buttocks becomes excoriated, and bed-sores form over the heels, the sacrum, or the occiput. The abdomen may be moderately distended, or it may be relaxed and soft. Tenderness is not usually present. The appetite is lost, and in most cases great difficulty is experienced in getting children to take a proper amount of nourishment. Continued aversion to food is an unfavourable symptom. Occasionally, when there is fever, fluids are taken eagerly. A returning appetite is always an encouraging sign. The mouth is often dry, the tongue coated, sometimes dry and brown; there may be sordes upon the lips and teeth. Superficial ulcers form upon the mucous membrane of the mouth, and often thrush is seen. The urine is usually diminished, high-coloured, and loaded with urates. Albumin and casts are rarely present. In only two cases have I seen nephritis severe enough to form a factor in the result. Tenesmus and prolapsus ani are uncommon.

The average duration of the fatal cases is about three weeks; their course is often marked by exacerbations and remissions. If recovery takes place, convalescence is always very slow and relapses are easily excited.

Very few of these cases recover completely. Even those who survive the primary illness are likely to suffer from intestinal symptoms for many months. Fatal relapses are often brought on by injudicious feeding when the children are apparently almost well. The general health is usually so undermined that the patients continue to suffer from all the symptoms of malnutrition, and ultimately succumb to an attack of some intercurrent acute disease.

The diagnosis of ulceration is to be made from the case as a whole rather than from any special symptoms. If a delicate infant which has previously been prone to diarrhœal attacks, has green mucous stools with low fever, and these continue with unabated severity for ten or twelve days, ulceration is probable. If such symptoms continue for three or four weeks with steadily failing strength and loss of weight, the diagnosis is almost certain. If, on the contrary, after three or four days of acute symptoms there is improvement in the stools and occasionally some which are quite fæcal in character, even though it may be a week or more before the mucus disappears, we may be quite certain that no ulcers have formed.

(4) *The membranous form.*—This occurs most frequently between the ages of six months and two years, and often attacks those previously in good health. It is the gravest form of inflammation of the intestine seen in children, and its symptoms are severe usually from the outset. It closely resembles the most severe cases of catarrhal inflammation. The disease begins suddenly, with vomiting, high temperature, and several large, fluid stools. The vomiting does not often continue after the first twenty-four hours. The temperature is at first from 102° to 105° F., and its course may be steadily high (Fig. 58), or remittent. In some cases the constitutional symptoms—prostration, stupor, delirium, etc.—are so severe at the onset that the intestinal symptoms are masked by them and an erroneous diagnosis is made. The abdomen is usually tender and sometimes swollen. There is severe pain, and

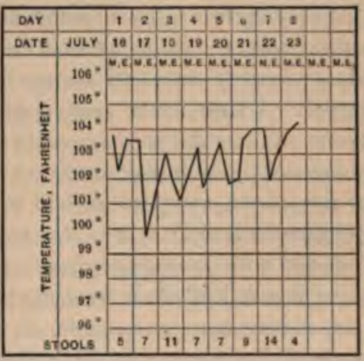


Fig. 58.—Temperature chart of membranous colitis; fatal.

at times almost constant tenesmus, during which prolapse of two or three inches of the mucous membrane of the rectum occurs. This is intensely congested, and sometimes shows patches of pseudo-membrane upon its surface, thus establishing the diagnosis.

The stools resemble those of the catarrhal variety, except that blood is more constantly present and usually more abundant; but the only positive point of difference is the presence of shreds or patches of pseudomembrane. If the stools are thoroughly washed with water, patches of membrane may be seen as gray opaque masses, which are then easily distinguished from the transparent mucus. Large sheets of membrane are seldom discharged; usually only small patches are found. Both blood and mucus sometimes disappear from the stools, which may consist only of dirty water. Under the microscope there may be seen epithelial cells, red blood-cells, and round cells in great numbers.

The duration of the disease is usually a little less than two weeks. The course closely resembles that of the severe catarrhal form. There may be a continuous high temperature with severe intestinal symptoms and great prostration until death takes place from sepsis or exhaustion, or after three or four days the temperature may fall to 100° or 102° F., rising again at the termination of the disease. The most protracted fatal case I have known lasted four weeks. It is probable that almost every case of the severity described, terminates fatally when it occurs in an infant. In older children the prognosis is much better as to life, but in them the acute attack may be followed by the chronic form of the disease.

Diagnosis.—Ileo-colitis is to be distinguished from typhoid fever and intussusception. In infancy a doubt between typhoid fever and ileocolitis does not often arise. Cases of typhoid fever under twenty months are extremely rare, and are not likely to be seen unless the disease is epidemic. I have never seen a case under this age. In children over two years, the two diseases are more likely to be confused. Typhoid is distinguished by the slower invasion, more constant temperature, enlargement of the spleen, tympanites, and most of all by the eruption. The fact that the disease is epidemic is also to be considered. Acute colitis may be confounded with intussusception. If the possibility of this mistake is kept in mind it will not often be made; yet the records of intussusception show that a very large proportion of them were regarded in the beginning as cases of dysentery. In intussusception, although we have a sudden onset with acute pain, tenesmus, vomiting, and marked prostration, there is no fever. The later symptoms—absolute constipation, tumour, tympanites, rising temperature, stercoraceous vomiting, and collapse—have nothing in common with colitis. A diagnosis between the different varieties of ileocolitis is not always possible. Follicular ulceration is distinguished by its lower temperature, rather subacute course, infrequency of blood in the stools, and by the fact that it is usually preceded by one or more attacks of acute gastro-enteric infection, upon which its peculiar symptoms are gradually ingrafted. In both the catarrhal and the membranous varieties, the symptoms of an acute inflammation of the colon are usually manifest from the outset—bloody stools, much pain, tenderness, tenesmus, and fever. They differ chiefly in severity, and by the fact that in the membranous form shreds of false membrane may be found in the stools. The course is shorter and the attack is altogether more intense than in the follicular form. Death often takes place in ten or twelve days, during the period of most acute symptoms. The protracted cases of catarrhal ulceration can not be distinguished from the more common ones of follicular ulceration.

Prognosis.—This is much worse in infants than in older children. It is especially bad in cities, among the poorer classes, and in institutions. It is rendered unfavourable by previous rickets or malnutrition, and by the existence of any complication, particularly broncho-pneumonia. The prognosis is worse in children who have been badly fed, in those recently weaned, and in those who earlier in the season have suffered from attacks of diarrhœa. The particular symptoms which make the prognosis unfavourable in a case are continued high temperature, frequent vomiting, rapid wasting, an excessive amount of blood in the stools, severe nervous symptoms, and very weak pulse. These cases are never out of danger until the end of the hot season, on account of the great liability to relapses and recurrent attacks.

Prophylaxis.—What has been said regarding general prophylaxis in the previous chapter, applies equally well to cases of ileo-colitis. Special emphasis should be placed upon the necessity of energetic early treatment of all the milder forms of diarrhœa, and particularly the cases of acute gastro-enteric infection, in order that the process may be arrested before serious anatomical changes have taken place—a thing which is often possible. Equal stress should be laid upon the importance of prompt and radical treatment at the very beginning of the cases with a sudden onset.

Hygienic Treatment.—The general plan recommended in the previous chapter should be followed here. A change of air is desirable for every case as soon as the acute inflammatory symptoms have subsided. In the protracted cases which drag on a subacute course, this change will often do more than everything else. Some children do better at the seashore, and others in the mountains. If possible, patients should be kept in the country until the last of September. A return to the city during the hot season is usually followed by a second attack, and, if the patient has not quite recovered, relapses are almost certain. Plenty of pure fresh air is necessary in all cases. The indications for bathing are the same as in other cases of acute diarrhœa. It is undesirable to crowd these patients in institutions, as they always do better when they can be separated. The dietetic treatment during the acute stage is the same as in cases of acute gastro-enteric infection. Special stress should be laid upon stopping cow's milk at once. In the protracted cases the diet presents great difficulties, as the children have little or no appetite, and soon come to refuse everything in the shape of food that is offered. In infancy, the articles which are most to be depended upon are skimmed milk which has been completely peptonized, beef juice, broths, and liquid beef peptonoids. In some cases rice or barley water are well borne; in others, some of the malted foods, although these often increase the number of stools and have to be stopped on that account. Food which leaves little residue should always be chosen. Infants, when very ill, are much more likely to take too little than too much food. A careful record should be kept of the amount actually taken in each twenty-four hours. When this is much below the requirements of nutrition, gavage (page 62) may be tried. Sometimes all food and stimulants may be advantageously given in this way. In no case should food be given oftener than every two hours, and usually the interval should be three hours, water and stimulants being allowed between the feedings. In older children the diet during the acute stage must be much the same as in infancy. At a later period, raw beef, kumyss, or matzoon will be found useful, and during convalescence boiled milk or milk gruels made with rice or barley. Special care must be given to the diet for a long time. For months after an acute attack the intestines are very easily deranged. Relapses are excited by changes in the temperature, by great fatigue or exhaustion, but most of all by improper feeding. Especially in older children should such articles be avoided as oatmeal, potatoes, corn, tomatoes, and all fruits. I have seen a single peach given to a child two years old, excite a dangerous relapse, and a few raisins a fatal one.

Medicinal and Mechanical Treatment.—Cases, the early stage of which is marked by vomiting and thin diarrhœal stools, are to be managed at the outset according to the plan outlined in the previous chapter—viz., free purgation, irrigation of the colon, and stopping all food. Lesions of any considerable severity are not often present during the first week. In the cases in which the symptoms of acute inflammation are evident from the outset, as shown by the frequent bloody and mucous stools with tenesmus and pain, the measures to be depended upon are castor oil and irrigation of the colon, and later opium and bismuth by the mouth. Castor oil should be administered in a full dose at the outset—one drachm at six months, two drachms at one year, and half an ounce at four years. Its primary effect is to clear the intestines, and its secondary effect is peculiarly soothing to the inflamed mucous membrane. If the stomach is at all irritable, calomel one fourth grain every hour to six or eight doses, or a saline purgative, may be substituted. Opium is usually required on account of the pain and tenesmus. The dose should be regulated by the severity of these symptoms and by the frequency of the stools. The deodorized tincture and morphine are, I think, preferable to other preparations. Dover's powder may be used if the stomach is not irritable. Repeated small doses are better than a single large dose. It is very important that opium should be withheld for at least twelve hours after the initial purgative. As the pathological process is principally in the colon, and most severe in the lower half of the colon, it can be much more effectively treated by injections than by drugs given by the mouth. Irrigation of the colon (page 63) is one of our most valuable means of treatment in these cases. It should be used in conjunction with the measures already referred to. For general purposes a tepid saline solution should be employed (common salt one drachm to water one pint). At least a gallon should be given at one time; it should be injected high into the colon through a long rectal tube, and early in the disease repeated at least twice a day. Where the tenesmus is very great and blood abundant, either hot water (106° to 110° F.) or ice water may be used, and later astringent injections. A large amount of a weak solution may be given and allowed to escape, or after irrigating with a saline solution, a smaller quantity—three or four ounces—of a much stronger astringent may be introduced high into the bowel and prevented from escaping by compressing the buttocks. The most useful astringents are tannic acid and hamamelis; as a weak solution, half a drachm of tannic acid or one drachm of the fluid extract of hamamelis may be used to a pint of water; and for a strong solution, the same quantity of the astringents to three or four ounces of water. Nitrate-of-silver injections should never be used in acute cases, and their advantage in chronic ones is questionable. In conjunction with opium, benefit is often seen during the early stage by the continued use of castor oil in small doses—i. e., ten drops in emulsion every two or three hours.

For cases not influenced by the measure mentioned, or those not seen at the outset, bismuth should be tried, but it is of no use whatever unless large doses are administered. Two drachms of the subnitrate must be given in twenty-four hours to a child a year old, and proportionate doses for older children. This should be suspended in mucilage. Tenesmus and pain are sometimes relieved by the injection of three or four ounces of a starch solution to which from five to ten drops of laudanum are added. Severe tenesmus, when not controlled by the measures above mentioned, and when associated with prolapsus ani, is sometimes immediately relieved by cocaine suppositories. From one fourth to one grain of cocaine may be given, according to the child's age.

Stimulants are needed in nearly all cases. There are no valid objections to their use even in the youngest infant. The feeble digestion and assimilation of these patients compel us to use alcohol very frequently. Stimulants are indicated by a weak pulse, poor circulation, and great general prostration, no matter at what stage in the disease these symptoms are seen. Old brandy is usually to be preferred. Generally not more than thirty drops every two hours are needed for an infant one year old, but for short periods a much larger quantity may be required. Brandy should always be diluted with at least six parts of water.

In cases where symptoms have lasted two or three weeks, and the active symptoms have subsided, where the temperature is scarcely above 100° F., and the stools reduced to four or five a day, it is wise to stop all medication and attend only to food and stimulants, with irrigation of the colon every other day. One is often surprised at this stage to find that his patients do better without drugs than with them. The prevailing tendency is to overdose cases of this type. Careful attention to diet, judicious stimulation, regular irrigation of the bowel every day or two, with change of air, will do much more than any amount of medication.

During convalescence general tonics are required, such as arsenic, iron, nux vomica, and wine. Cod-liver oil should be deferred until the stomach and appetite are quite normal and the stools free from mucus. It should, however, be continued throughout the succeeding winter months.

CHRONIC ILEO-COLITIS.

This is rarely seen except as a result of acute ileo-colitis, which is usually catarrhal or follicular, as the membranous variety is so severe that the patients rarely survive the acute stage. In the catarrhal form there may be a chronic catarrhal inflammation of the mucous membrane only, or there may be catarrhal ulcers. In the follicular form ulcers are usually present.

Lesions.—*Catarrhal form.*—In its milder type it is quite common, but in its severe grade it is exceedingly rare. There may be changes in a large part of the small intestine and in the stomach, as well as in the lower ileum and colon.

The gross appearance of the intestine often differs very little from the normal. The mucous membrane is usually of a dull gray or slate colour. Pigmentation may occur as striæ in the mucous membrane, but more frequently it is limited to Peyer's patches and the solitary lymph nodules; these, as well as the mesenteric lymph nodes, are generally swollen.

The microscopical changes are usually marked. The lesion is chiefly one of the mucosa. (Fig. 59). The important features are a disappearance of very many of the tubular glands, and in the small intestine of the villi also. There is a very marked cell proliferation in the adenoid tissue of the mucosa, and if the disease has existed long enough there may be a production of new connective tissue. The solitary lymph nodules show usually nothing but cell hyperplasia. The lesions are not uniformly distributed, but occur in patches throughout the intestine. When present in the stomach, they are of the same kind as those described in the intestine, although rarely so severe. In milder cases the gross appearances may show very little change to the naked eye, except swelling of the lymph nodules. Under the microscope there may be found more or less extensive cell infiltration of the mucosa, but rarely any destructive changes or new connective tissue.

Ulcerative form.—This is rather rare, for the reason that in infancy a very large proportion of the cases die during the acute stage.

The ulcers are nearly always of the follicular variety; occasionally they are catarrhal. If the patient dies after an illness of from six to eight weeks, the appearances do not differ essentially from those described in acute cases. If life is prolonged from two to four months, ulcers are found in various stages of repair, sometimes associated with the formation of small cysts. Follicular ulcers require from two to four months for cicatrization, and the broad catarrhal ulcers even a longer time. It is very doubtful whether stricture ever results from these ulcers in children.

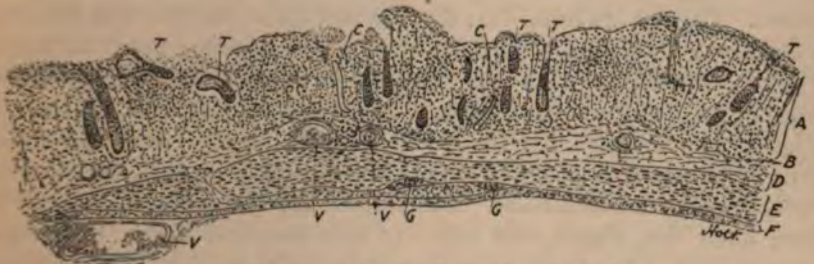


FIG. 59.—Chronic catarrhal inflammation of the ileum.

The lesions affect the mucosa, *A*, almost exclusively. It is somewhat thickened; there is extensive destruction of the tubular follicles, remains being seen at *T*, *T*; there is a great increase in the cells, and some new connective tissue in the mucosa. Large new blood-vessels are seen at *C*, *C*. *History.*—Delicate child, thirteen months old; diarrhœal symptoms for four months; during the first two weeks there was high fever: at death weighed eight pounds. The gross changes at the autopsy were very slight. The section is from the middle ileum.

The mucous membrane shows almost invariably evidences of more or less extensive chronic catarrhal inflammation. One of the rarest lesions are cysts of the colon. Fully developed cysts I have seen but once. The child had an attack of acute ileo-colitis, which became chronic, lasting about five months. He never regained his health, and died one year later from intercurrent disease. In the descending colon and rectum, about twenty cysts the size of a pea, and many smaller ones, were found. They had a thin, translucent covering. On section, a thick, transparent, gelatinous material escaped. They were situated in the submucosa, and were undoubtedly produced by the dilatation of some of the tubular glands whose orifices had been obliterated.

Associated lesions.—The important ones are in the lungs, the most common being hypostatic congestion, subacute or chronic broncho-pneumonia, more rarely pulmonary tuberculosis. It is rare to find the lungs perfectly healthy. The liver is often found extremely fatty in cases associated with great wasting, but in no case have I seen hepatic abscess. The kidneys usually show a more or less intense cloudy swelling, and sometimes there may be well-marked nephritis. Dropsical effusions into the serous cavities are very rare. General tuberculosis is not infrequently the cause of death.

Symptoms.—These cases are usually seen in the autumn, and comprise those which have barely managed to live through the summer months. No definite line can be drawn between the acute and the chronic stages. Under the head of chronic cases, all those which have lasted over six weeks will be included; although some become chronic in a shorter time.

The symptoms of active inflammation have passed away; the temperature is usually normal; there is no pain or tenderness. There is, however, no improvement in the general condition, and either the weight remains stationary, or the child continues to lose slowly until it is little more than a skeleton. The face is pinched, the eyes sunken, and the cheeks hollow. The lips are pale, often fissured, and bleed readily. The fontanel is depressed. The body is so small that the head seems much too large. Almost every vestige of fat may disappear from the subcutaneous cellular tissue of the trunk and extremities. The skin hangs in loose folds on the thighs. The abdomen may be distended and tympanitic, or retracted and soft. The mouth is often the seat of thrush, of catarrhal, herpetic, or rarely of ulcerative stomatitis. The tongue may be heavily coated, but is more often dry, glazed, and red. In rare instances sordes covers the lips and teeth. The teeth sometimes decay quite rapidly from the general malnutrition. Baginsky states that the progress of dentition is arrested; but I have very often seen these infants, almost "living skeletons," go on cutting teeth quite as steadily as under normal conditions, and Eustace Smith has made the same observation.

Although they seldom cry for food, as a rule, these children will take nearly everything given them, and an almost unlimited amount. Notwithstanding that it is retained, the more they are fed the more rapid seems the wasting. Vomiting is not common, and seldom occurs except from overloading the stomach or during an acute exacerbation of the symptoms.

The stools are rarely frequent; five or six a day being the average; often there may be only two or three a day for a week at a time. They are thinner than normal, but are not often fluid. They contain mucus of a green or brownish colour, usually in large quantity. Blood is rarely present. The stools are sometimes green, often greenish brown, sometimes a pale gray. Undigested food is always present in quantity, and upon the diet depends very much the gross appearance of the stool, the odour of which is almost always offensive, sometimes extremely so. Pus is found under the microscope, but is rarely visible to the naked eye. Nothnagel and Baginsky have called attention to a form of stools which they believe to be characteristic of wide-spread inflammation of the mucous membrane with atrophy of the tubular glands: they are of nearly normal consistence, homogenous, dark green or brown colour, and usually offensive; they sometimes alternate with stools of a watery character; under the microscope nuclei are found, but no unchanged epithelial cells; the food-remains are sometimes unrecognisable, from the extent to which decomposition has taken place.

Prolapsus ani is not so frequent as in the acute cases; but when it occurs it is generally more difficult to control. Flatulence and colic are prominent symptoms in some cases, but absent altogether in many others. As a rule, there is neither abdominal pain nor tenderness. When the abdomen is enlarged it is usually uniformly, but sometimes shows marked epigastric prominence, which is more often from dilatation of the transverse colon than of the stomach. The skin of the abdomen often seems very thin; dilatation of the superficial veins is rarely seen. The liver and spleen are generally normal in size, so far as can be made out by physical examination. Although the mesenteric glands are enlarged, they can not be felt through the abdominal walls. Enlargement of the inguinal and other groups of external lymphatic glands is rarely striking. The skin is loose, wrinkled, dry, and scaly, and in the worst cases frequently covered with small petechiæ over the abdomen and lower extremities. About the anus, and over the sacrum, thighs, genitals, and sometimes feet, there are excoriations, and not infrequently ulcerations. The pulse is weak, the peripheral circulation is poor, and the extremities are cold much of the time unless artificial heat is applied. The respiration is usually shallow, and often irregular without any apparent cause; it becomes rapid from the development of pulmonary complications. The temperature is elevated only during exacerbations, or from inflammatory complications. A subnormal temperature is frequently met with. I have occasionally seen it 95° F. in the rectum. A continuous subnormal temperature is a very bad sign. The urine shows no constant changes. Dropsy may be present without albuminuria. The weight is stationary, or steadily falls to an almost incredible degree. I have seen one infant weighing but eight pounds at thirteen months; another, thirteen pounds at two years and four months. There are marked cachexia and extreme anæmia. Ulcers of the cornea are not uncommon. Nervous symptoms are always present. The children are cross and irritable, sleep badly, and frequently have a low, whining cry, which is continued much of the time. Sometimes they are dull, apathetic, and quite indifferent to their surroundings. Persistent opisthotonus is occasionally seen; and there may be contractions of the extremities, but rarely general convulsions.

The duration of the disease is from two months to a year. Comparatively few patients survive more than four months. The progress is irregular, and marked by periods of improvement, during which for a time the patient may hold his own, or even gain in weight. Any trivial cause may excite a relapse, and the downward progress is rapid. Death often occurs during one of these exacerbations, or it may be due to broncho-pneumonia, tuberculosis, or slow asthenia.

Diagnosis.—The problem usually presented is, whether the condition of the bowel is of itself a sufficient explanation of the general condition, or whether there is some underlying constitutional disorder, of which the diarrhœa is only one of the symptoms. It is important to distinguish the cases in which the cachexia is quite marked and convalescence slow—although ultimately resulting in complete recovery—from those which present at a certain stage almost identical symptoms, and yet go on steadily from bad to worse, terminating fatally. The difference in these cases is really a difference in the character and extent of the lesions. The first group are probably cases of superficial catarrhal inflammation, or of follicular inflammation which has not gone on to ulceration, these lesions being capable of repair. The second group are the cases of follicular or catarrhal ulceration, in which complete recovery from the lesions is impossible, and repair only partial, if indeed any occurs. In distinguishing between these cases the most important guide is the nature of the symptoms during the antecedent acute attack. The longer the acute febrile symptoms have lasted and the higher has been the temperature, the greater probably is the extent of the lesions, and the more severe their character.

The diagnosis of chronic ileo-colitis from general tuberculosis is difficult, particularly so from the fact that tuberculosis is not an infrequent sequel to the intestinal disease. The points in common are the existence of diarrhœa (which may occur in tuberculosis in summer apart from the presence of intestinal tuberculosis), anæmia, cachexia, and the signs of consolidation in the lungs; these, in the one case, depending upon broncho-pneumonia, and in the other upon tuberculous deposits. Tuberculosis is more likely to be met with in institutions, among the poor of cities, and in children previously delicate and with a tuberculous family history. In chronic ileo-colitis the wasting and anæmia follow the intestinal symptoms, and are usually just in proportion to their severity. For the differential diagnosis of the pulmonary condition see the chapter on Pulmonary Tuberculosis. Of the constitutional symptoms the most important differential one is fever. This is rarely absent in general tuberculosis or in tuberculous ulceration of the intestine if extensive, though it is not high and its course is very irregular. It is absent in chronic ileo-colitis, except from complications and from the occasional acute exacerbation.

Prognosis.—The prognosis depends upon the child's previous constitution, upon the duration of the intestinal symptoms, upon our ability to carry out proper treatment, upon the presence of complications; but, most of all, upon the severity and extent of the intestinal lesions. The possibility of error always exists in estimating the gravity of the lesions, so that no case should be considered hopeless. Every physician who sees much of this form of disease, has met with cases so weak, so wasted, and so anæmic that recovery seemed out of the question; and yet after a few weeks, under favourable conditions, they have begun slowly to improve, and finally have gone on to complete recovery. If, however, continuous symptoms have existed for eight or ten weeks without any sign of improvement, recovery is extremely doubtful. The patient may linger for two or three months longer, but usually only to be carried off by the first acute disturbance which occurs.

Treatment.—Little or nothing is to be expected from drugs. No greater mistake is made than to give these children week after week the various diarrhœa-mixtures, with the expectation that ultimately the formula which exactly meets the wants of the particular case will be found. Drugs are to be used only for the relief of special symptoms. Thus a dose of opium may be needed when the movements are unusually frequent, or castor oil once in four or five days when the stools are particularly offensive. The essential and important part of the treatment consists in injections, careful feeding, stimulation, and change of air. Astringent enemata, however, are of considerable value. They should be given daily or every other day, but from time to time should be discontinued to see what the condition of the stools is without them. They should be used as described in the treatment of acute cases after irrigating the colon with a tepid salt solution (one ounce to the gallon). The stronger astringent solutions should be used, and held in place for half an hour.

Alcoholic stimulants must be given in almost all cases, and they may be continued for a long time with advantage. Old port or sherry will sometimes do better than brandy or whisky. The diet mentioned in the later stages of the acute cases should be continued. Usually we give that which the patient will take most readily. The predigested foods are useful; so also are such beef preparations as bovinine, and the liquid beef peptonoids. Raw scraped beef may be used with great benefit. Fats and starchy foods should be excluded entirely or given in very small quantities. It is usually better to give the carbohydrates in the form of the malted foods. Kumyss and matzoon are useful. The diet must be carefully watched and directed according to the effect upon the stools of the various articles employed. In some of these cases nutrition may be promoted by inunctions of cocoa butter, cod-liver oil, or some other form of fat.

The patient must first be put in the best possible surroundings; in no disease is a change of air more to be desired than in this. These cases are trying ones to the physician; for unless he can absolutely control the matter of diet, it is almost useless to attempt to do anything. Still, by careful study of the individual case and attention to minute details, success may sometimes be achieved even when the outlook seemed at the outset the most hopeless. The danger of relapses and second attacks continues long after the primary attack has sudsided.

AMYLOID DEGENERATION OF THE INTESTINES.

This is rarely met with in infants. It is not so infrequent in older children, where it is associated with amyloid changes in the liver, spleen, and kidneys, usually as a result of prolonged suppuration in connection with bone tuberculosis. It is sometimes met with in syphilis. The ileum is the part of the intestine most affected. The process begins in the walls of the arterioles and capillaries, particularly of the villi, and later involves the vessels of the submucosa; subsequently the epithelium may be affected. The mucous membrane in these cases is pale, rather translucent. The condition is recognised by the application of the iodine test. This is best seen in the lower ileum, where the affected villi become of a brownish-red or mahogany colour.

Amyloid degeneration produces no definite symptoms. Diarrhœa is frequent but by no means constant. The anæmia and waxy cachexia which are present are probably dependent much more upon the associated lesions of the liver and kidneys than upon the changes in the intestines. The treatment is symptomatic.

TUBERCULOSIS OF THE INTESTINES AND MESENTERIC LYMPH NODES (MESENTERIC GLANDS).

These two conditions are usually, but not invariably, associated, and may conveniently be considered together.

Frequency.—In 109 autopsies of my own upon tuberculous cases in which the condition of the intestines was noted, they were involved in 37 per cent. The great majority of the patients were under three years of age. In 131 autopsies upon tuberculous cases published in the Pendlebury Hospital Reports, the intestines were involved in 50 per cent. These patients were mainly between four and fourteen years old, very few of them being infants. In 209 autopsies upon tuberculous children, chiefly infants, reported by Müller, the intestines were involved in 28 per cent. In 1,346 autopsies collected by Biedert there were intestinal lesions in 31·6 per cent. These figures show that the intestines are not one of the most frequent seats of tuberculosis in children, and that it is rather less frequent in infancy than at a later age. It is most common from the third to the eighth year. The figures for tuberculosis of the mesenteric lymph nodes are nearly the same as those for the intestines. They were tuberculous in 35 per cent of my own autopsies, and in 59 per cent of the Pendlebury cases. Müller and Biedert do not give the proportion.

Etiology.—In all or nearly all cases, the mesenteric lymph nodes are infected from the intestines. It is of course possible, but unlikely, that the infection may be through the general circulation. With tuberculous ulcers of the intestine, the lymph nodes are, I think, invariably found by inoculations to be tuberculous; although they may not yet be caseous. The infection of the intestinal mucous membrane is from bacilli in the canal. Much stress has been laid upon tuberculous milk as a means by which children are infected. There is little pathological support to be found for the view that children often contract the disease in this way. In 119 autopsies upon tuberculous children, chiefly infants, there was not found one in which the most advanced, and therefore presumably the primary, lesion was in the intestines or stomach. In 127 autopsies, also upon tuberculous infants, Northrup found the most advanced lesion in the intestines in but a single case. While infection from milk is possible, it is certainly extremely infrequent. In my own autopsies, intestinal lesions have been found only in marked cases of generalized tuberculosis. In not more than one fourth of the cases in which such lesions were present were they severe. They were usually associated with an advanced pulmonary process, and were doubtless due to swallowing tuberculous sputum.

Lesions.—*Intestines.*—Tuberculosis usually affects the small intestine; with very extensive disease the large intestine may also be involved, and exceptionally it alone may be affected. The disease in the small intestine is usually found in the jejunum, and in the lower ileum near the ileocæcal valve. Of the large intestine, the cæcum is most often diseased; ulcers are often found in the appendix.

If seen very early there may be only tuberculous deposits, usually widely scattered, involving the solitary lymph nodules, or Peyer's patches. These appear as tiny yellow nodules. Usually, however, ulcers are present, and often only ulcers are seen. Their size and number vary greatly; there may be only five or six tiny ulcers, or there may be forty or fifty, the largest being two or three inches in diameter. They very frequently involve the Peyer's patches. The typical tuberculous ulcer is of irregular shape, with rounded borders and with its longest diameter at right angles to the intestinal axis. When large, it may nearly encircle the gut. The ulcers are excavated; they have overhanging, infiltrated edges of a deep red colour. The surface is covered with granulations. In those which have partly healed a distinct puckering of the intestine occurs, which is especially noticeable upon the peritoneal surface. The small ulcers involve the mucosa only; the larger and older ones the submucosa and the muscular coats, and not infrequently also the serous coat. Perforation may occur, but rarely into the general peritoneal cavity, as a localized plastic inflammation precedes it. There may be adhesions of adjacent intestinal coils, and fistulæ may form, owing to ulceration at their point of contact. With these severe cases there is always associated more or less extensive tuberculous peritonitis, frequently of the ulcerative variety. Like other tuberculous processes, the infiltration and ulceration may cease at any stage, and cicatrization follow. If the ulcers have been large ones, there is always some narrowing of the lumen of the intestine. Stricture rarely results, because the patients die from the general disease before it has had time to occur. Monti has reported a case of obstruction at the ileo-cæcal valve, due to an old tuberculous cicatrix, in an infant of twenty-one months.

Mesenteric lymph nodes.—Usually these tuberculous lymph nodes are from half an inch to an inch in diameter; occasionally they may reach the size of a hen's egg. From a fusion of several of them, tumours of considerable size may be formed. I have seen one as large as the head of a child at birth.

The process is the same as that which occurs in other lymph nodes in the body. There is a tuberculous inflammation, followed by caseation, softening, and abscess, or by calcification. Localized peritonitis is found in all the marked cases; this is usually plastic, but may be suppurative when due to the rupture of an abscess. Pressure upon the vena cava may lead to dropsy in the lower extremities. Ollivier has reported a case in which thrombosis of the vena cava occurred. Pressure upon the portal vein may lead to ascites and dilatation of the superficial abdominal veins. There may be pressure upon the thoracic duct.

Symptoms.—The symptoms of intestinal tuberculosis are exceedingly irregular. Ulcers are very frequently found at autopsy when there have been no marked intestinal symptoms; this is especially true of the small ulcers seen in infants. On the other hand, diarrhœa is not uncommon in cases of advanced general tuberculosis where no ulcers are present. It is the most frequent symptom, and may be exceedingly obstinate. The stools do not differ essentially from those in chronic ileo-colitis, except in the occurrence of hæmorrhages and in the presence of tubercle bacilli. Hæmorrhages are not very frequent, but they may be so large as to be the cause of death. This occurred in one of my cases, an infant nine months old, the blood coming from a single ulcer in the ileum. Hæmorrhage is more common in older children. In some cases localized abdominal pain or tenderness is present. In advanced cases the symptoms of intestinal ulceration are usually mingled with those of peritonitis, and there are also present the enlarged mesenteric lymph nodes, which may aid in the diagnosis. In the vast majority of cases, these nodes are recognised only by palpating the abdomen. They can rarely be felt unless they are at least an inch in diameter. In making palpation, the hands should be placed upon the abdomen laterally, and slowly brought together at the spine. The tumours are generally felt as irregular nodular masses, lying close against the spine, not movable, and sometimes tender on pressure. The other symptoms are due to the complications which have been already mentioned.

Diagnosis.—The only positive evidence of intestinal tuberculosis is the discovery of the bacilli in the stools. In the absence of this evidence, the disease is differentiated from simple ileo-colitis, first, by the signs of tuberculosis elsewhere in the body, especially in the lungs, these being almost invariably involved; secondly, by the slow onset and gradual development of the symptoms, while in chronic ileo-colitis an acute attack has almost invariably preceded. Large hæmorrhages always suggest tuberculosis.

The large mesenteric glands are recognised only as abdominal tumours.

Prognosis.—This depends altogether upon the extent of the tuberculous disease elsewhere, as it is extremely rare for the intestinal lesion to be the cause of death. Once formed, the ulcers probably remain, cicatrization being very rare, and then only partial.

Treatment.—The only symptom which ordinarily demands treatment is the diarrhœa. When severe, this is to be managed much as in cases of ileo-colitis, except that irrigation of the colon is, of course, not called for. The chief reliance must be upon diet and internal medication. The drugs which are most useful are bismuth, opium, and creosote, which should be given in pills coated with shellac.

CHAPTER IX.

DISEASES OF THE INTESTINES.—(*Continued.*)

CHRONIC INTESTINAL INDIGESTION.

As the larger and more complex part of the process of digestion goes on in the intestine, so intestinal indigestion is a more common and more complicated disturbance than gastric indigestion. In many cases we find the two associated, but in perhaps the majority the symptoms relate entirely to the intestinal process. The conditions seen in young infants are so different from those in older children that the cases may be best considered separately.

IN YOUNG INFANTS.—The general causes are the same as those mentioned in connection with chronic gastric indigestion: they are constitutional debility, either congenital or acquired, unfavourable surroundings, and previous attacks of acute disease. Chronic intestinal indigestion is especially common during the first six months, and is seen both in nursing infants and in those who are artificially fed. In the case of breast-fed infants the mother is often highly nervous, delicate, and anæmic, and is taking large quantities of fluids of every description, by means of which an abundant flow of milk is maintained. Why it is that the milk causes so much disturbance can not always be discovered even by the most careful analysis. The difficulty seems to be most frequently with the proteids, which are often in excess. Sometimes, proteids differing in character from those normally present seem to be produced, as the stools show that they are not digested. The microscope in some cases reveals the presence of many colostrum corpuscles in the milk. In another group of cases, where the condition of the nurses is all that can be desired, the trouble is simply that the milk is too rich; it being then high both in fat and proteids. It may come, although rarely, from the fact that the child gets too much, being nursed either too frequently or for too long a time.

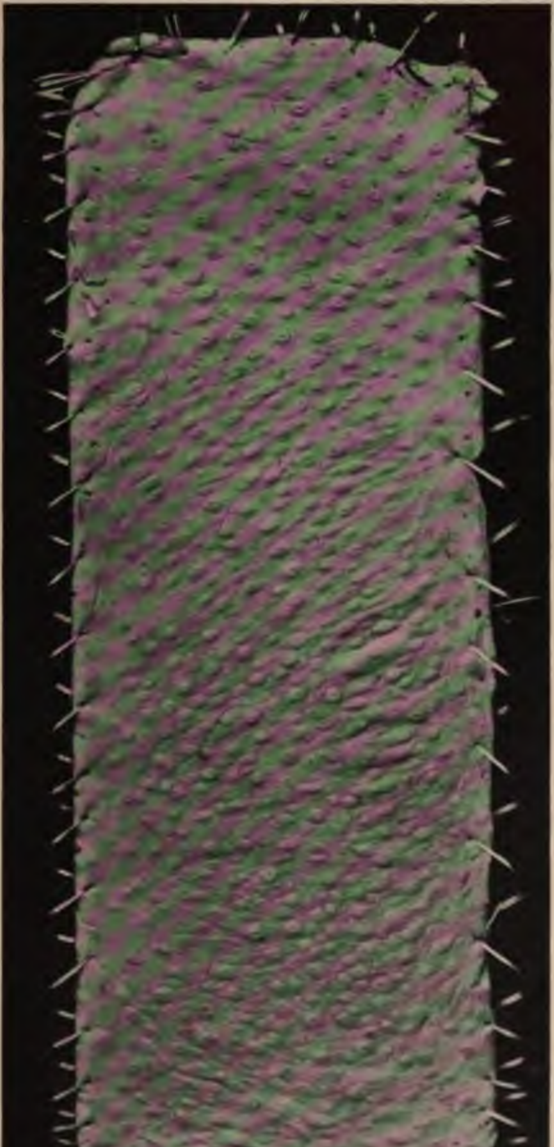
In infants who are being fed upon cow's milk, the most common cause is that the proteids are too high; this is usually the mistake when infants are fed upon plain milk which has been simply diluted. In other cases the fat may be excessive, as in many of the milk-and-cream mixtures in vogue. Sometimes both the fat and the proteids are too high. Next to this mistake in proportions, is that of over-feeding. When other substances than cow's milk are used as foods, the usual trouble is that they contain a large proportion of starch.

Lesions.—Strictly speaking, chronic indigestion is a functional disorder without anatomical changes. Where the condition has lasted for many weeks or months, as often happens, there may result a low grade of catarrhal inflammation in the colon, attended by hyperplasia of the lymph nodules of the mucous membrane (Plate XI), and sometimes by a similar process in the mesenteric lymph nodes. Chronic indigestion may be the principal and the only symptom in cases of chronic ileo-colitis which have followed an acute attack.

Symptoms.—The general symptoms are those of malnutrition, or in the more severe form, those of marasmus. These have already been fully described (page 204), and need only be mentioned here. The most important are stationary or losing weight, anæmia, poor circulation, often subnormal temperature, almost constant fretfulness and crying, with very little quiet sleep. The tongue is usually coated and the appetite often good, these infants taking food whenever given, and in an almost unlimited quantity. There are few cases in which occasional vomiting does not occur, but it is rarely persistent. So far as the intestinal condition is concerned, the cases may be divided into those with diarrhœa and those with constipation. It may happen that the same child will suffer for a long time from diarrhœa and then from constipation, or the reverse; but usually one condition or the other is habitual. The diarrhœal stools are thin, green, and almost invariably contain curds, either in large lumps or small, flaky masses. They vary in number from three to ten in twenty-four hours. They are commonly passed without pain, although there may be flatulence. The stools have usually a sour, unpleasant odour, but they are rarely foul. They may be irritating to the skin, and cause troublesome excoriations or intertrigo. In some cases the stools contain but little solid matter, the character being that of yellowish-green water. In most of the cases, after the process has lasted two or three weeks, mucus is present, and may then become a constant feature.

If there is constipation, the stools are usually gray or white; they are smooth and pasty or like hard balls passed after much straining, often

PLATE XI.



Chronic Hyperplasia of the Lymph Nodules (Solitary Follicles) of the Colon.

Child ten months old; death from pneumonia without intestinal symptoms. Until five months old, nearly all stools were green or brown and contained mucus.

The condition shown existed throughout the colon.

coated with mucus and sometimes streaked with blood. Often the bowels will not move for days except after the use of laxatives or enemata. The latter often have but little effect, as the rectum may be empty. Constipated cases are especially prone to suffer much from flatulence and colic, the attacks of which may be very severe.

The duration of these symptoms is indefinite. There is little or no tendency to spontaneous improvement, and they may drag on for several months or until the problem of diet is solved. The progress of these cases is marked by frequent exacerbations, during which there is vomiting, and usually fever. These symptoms are generally dependent upon intestinal toxæmia. A low irregular fever may continue for days or even weeks. Although the general symptoms of failing nutrition are present in most cases, a mild degree of chronic intestinal indigestion with frequent loose movements may sometimes last for months, during which the patients may gain steadily in weight and give every indication of being well nourished. This is much more common in nursing infants than in those who are artificially fed.

Diagnosis.—It is not generally difficult to determine that an infant is suffering from chronic intestinal indigestion; but one should endeavour to go further in his diagnosis and discover which of the elements of the food is causing the chief disturbance. Thus, in an infant fed on cow's milk, we wish to know whether it is the casein, the fat, or the sugar; or, in another case, whether it is the starch of some proprietary food. Much valuable information may be gained from a careful history of what has already been tried in the case; often some gross error can be detected in the formula used or in the preparation of the food. Difficulty with the casein is usually shown by colic, constipation more often than diarrhœa, and by curds in the stools; often there is vomiting. Difficulty with the fat is indicated by loose movements, usually of a yellow colour. Sometimes they are white, smooth and formed, with a peculiarly offensive odour; there may be vomiting or the regurgitation of food in small quantities. Difficulty with the sugar is less common than with either the casein or fat, but there may be colic and diarrhœa, with thin, sour, irritating stools. Difficulty with the starch leads to much flatulence and colic, diarrhœa alternating with constipation, and offensive stools. One may find the foregoing symptoms in any combination, for in protracted cases the trouble is rarely limited to a single element in the food. If one is feeding cow's milk, the best way to arrive at a diagnosis is to begin with what would be a proper formula for a healthy infant somewhat younger, and watch the stools closely for two or three days. The proportion of the offending element should then be reduced until the symptoms it is causing disappear. By carefully modifying milk in this way, a diagnosis can usually be reached in a few days. Without it, all treatment is haphazard experimentation.

Prognosis.—This depends almost entirely upon how early the cases come under treatment and how they are managed. There is very little tendency to spontaneous improvement or recovery. The existence of chronic intestinal indigestion is one of the most important predisposing causes to more serious forms of intestinal disease, and in that consists its chief danger.

Treatment.—Drugs have no part in the treatment of these cases, except now and then for particular symptoms, such as constipation or colic. These infants are cured by proper dietetic and hygienic measures, and by these alone. The problem of diet has already been discussed in the chapter on Infant Feeding (page 180). For the general management of the case, which is not less important, the reader is referred to the chapter on Malnutrition.

IN OLDER CHILDREN.—Chronic intestinal indigestion is exceedingly common in children from the first to the fourth year. It is, however, seen throughout childhood, but after the age mentioned it is much less frequent. The younger children have usually been badly fed from the time of weaning from the breast or bottle. The almost universal mistake is that an excess of carbohydrates has been given, particularly potato and oatmeal. In many children these articles have been the most important part of the diet. Children suffering from rickets are very much more prone to chronic intestinal indigestion than are others, but it is seen in many in whom there is no trace of rickets, and in all grades of society—quite as often among the better class as in dispensary practice, although the type is usually less severe.

Symptoms.—The clinical picture which these cases present is a very common one, and the symptoms are quite uniform. Patients are generally very thin, with very small extremities, a small amount of fat, and large, protuberant abdomens. There is much flatulence, and in cases of long standing there is marked tympanites. The children are pale, anæmic, and sallow in complexion; they have dark rings under the eyes; they are easily fatigued on slight exertion; they are very cross, irritable, and emotional to an unnatural degree. They are hard to amuse, hard to control, and altogether exceedingly difficult patients to deal with. Their growth is retarded if the symptoms have lasted long. They are much below the average in height and weight. Even when not rachitic they walk late, and their general development is very slow. The sleep is always unnatural and disturbed; they can rarely be made to sleep with any regularity during the day, and at night they toss about their cribs, waking frequently, crying out and often grinding their teeth; this sometimes leading to the diagnosis of intestinal worms. They perspire very readily, and, like infants thus affected, they suffer from cold extremities.

The bowels are usually constipated, the stools being of a light gray colour or perfectly white. They are always formed and generally lumpy.

The odour from the discharges is usually extremely foul. In other cases there is chronic diarrhœa. The stools are not very frequent, rarely exceeding four or five a day, but they are large, thin, gray, green, or brown in colour, very offensive, and always contain undigested food. They are often excited by the taking of food. From time to time, in many patients, large quantities of mucus are passed from the intestine; in some cases this comes to be a constant feature of the disease. It results from an intestinal catarrh, which has been set up by the irritation from the hard fæcal masses or from the chronic functional derangement. Large quantities of gas are expelled *per anum*. Pain is not a very common symptom in most cases, although in a few patients a localized pain of considerable severity may be complained of at certain times, lasting for a day or more. The appetite is capricious, and usually poor, but some patients will eat everything offered. Because of the disinclination to take simple food, the most indigestible and highly seasoned articles are often given, with the effect of increasing the severity of the symptoms. The tongue is often coated, although it may be quite clean; the breath is foul.

The nervous symptoms which these patients present are exceedingly varied, and often of the most puzzling character. In many cases they are so severe and so persistent as to lead to the diagnosis of organic disease of the brain. In addition to the condition of general nervous irritability, there may be opisthotonus, tetany, fainting attacks resembling somewhat the seizures of *petit mal*, exaggerated reflexes, attacks of dulness or sometimes stupor, with retracted abdomen, irregular pulse and respiration, and other symptoms strongly suggestive of tuberculous meningitis. Some patients have shown transient paralysis. Convulsions are not very uncommon. Headache and frequent attacks of vomiting, which are perhaps to be interpreted as instances of migraine, are occasionally seen. In fact, there is almost no end to the complexity of these cases and the combinations of nervous symptoms which they may present. Most of these are toxic in their origin. The skin shows frequently eruptions of erythema or of urticaria.

Slight fever, also of toxic origin, is sometimes present for many weeks, the temperature usually varying between 99° and 100·5° F. Sometimes for several days it may be normal, and occasionally may rise to 102° or 103° F. during a slight exacerbation in the symptoms. The urine of many of these patients contains a large quantity of indican; the amount present indicates very accurately the degree of intestinal putrefaction going on, and often fluctuates regularly with the nervous symptoms.

Intercurrent attacks of acute indigestion, with diarrhœa and vomiting, are common and quite easily excited. The course and duration of these symptoms are indefinite. In the most severe forms, if untreated, the patients gradually waste until they die from exhaustion, or fall easy victims to any acute disease which they may happen to contract. There is but little tendency to spontaneous recovery.

Prognosis.—This depends upon the duration of the symptoms, the general condition of the patient at the time treatment is begun, and upon how thoroughly it can be carried out. The symptoms, in the great majority of cases, have existed for several months at the time the case comes under observation. Generally, the greater the mistakes in feeding have been, and the more gross the violation of hygienic and dietetic rules, the better the prognosis. A child who has developed chronic intestinal indigestion of a severe type, in spite of the fact that the hygienic surroundings were good, and where the dietetic errors were not flagrant, is not nearly so hopeful a subject for treatment as one whose hygienic surroundings have been poor and whose diet has been especially bad. In cases like the latter, a removal of the causes and the institution of proper methods of treatment almost invariably result in immediate and striking improvement, unless the general vitality of the patient has been reduced to a very low point. In the other cases, where the mistakes have been less marked, and the condition is due more to constitutional than to local causes, the improvement is slower and less striking. Thus, as a rule, hospital patients improve more rapidly than those seen in private practice, because their previous treatment has been so much worse.

Treatment.—In no class of cases that the physician is called upon to treat are results more satisfactory than in many of those of chronic intestinal indigestion, where the intelligent co-operation of the parents or a trained nurse can be secured. If the parents themselves are lax in discipline, and are unable to control the child, an efficient trained nurse should be secured, into whose hands the exclusive management of the child should be placed. The essential part of the treatment is that relating to diet. In the second and third years the most important thing is to stop all starchy food for a considerable time, and put the patient upon an exclusive diet of rare beef or beef juice and milk. The milk for many of the patients must be peptonized, as the casein of cow's milk is often very difficult of digestion even by children three years old. By some the fat also cannot be digested, and skimmed milk should then be used; in very obstinate cases it should be peptonized for two hours; in the majority of cases, however, it is sufficient to peptonize it from fifteen to twenty minutes. Additional carbohydrates are often best given in the form of some of the malted foods, which may be continued until the child can digest some form of starch. The number of feedings should be five a day during the second year, and four a day for children during the third and fourth years. These should always be at regular intervals, and nothing whatever given between meals. The meat should be rare scraped beefsteak or mutton; from one to three tablespoonfuls may be allowed once a day. Fresh fruit, especially oranges, may usually be allowed once a day, given one hour before meals. Kumyss or matzoon is often of very great value in children who are not fond of milk, or who become tired of the diet. Although at first they are taken with difficulty, in many cases a fondness for them is very soon acquired. Sometimes they are invaluable.

After improvement has been going on for a month, bread may be added, at first in small quantities and once a day. This should preferably be stale bread, cut thin and dried in the oven until it is crisp, and given without butter. Two or three times a week raw oysters may be tried. Mutton, chicken, or beef broth, without vegetables, may be given occasionally in the place of one of the milk feedings. After this diet has been kept up for three or four months, if improvement continues, one of the green vegetables may be added once a day, preferably either spinach, stewed celery, or asparagus. After two or three months more of continued improvement, thoroughly cooked rice or macaroni may be given twice a week. With these articles of diet one can get along very comfortably for a year, and no larger variety should be given until all the symptoms have disappeared. When starchy food is finally allowed, it should be only in small quantities, and usually with some preparation of malt. Potato and oatmeal should be forbidden for a long time.

Intestinal irrigation (page 63) is useful in all cases in which there is much mucus passed. A saline solution should be employed. The irrigation should be given at first daily, and after a week or two every other day, and, later still, once or twice a week. This seems not only to exert a favourable influence upon the catarrh in the colon, but also upon the lower part of the small intestine.

The constipation can usually be controlled by the diet mentioned. If not readily so, calomel should be administered occasionally, and abdominal massage employed. Calomel seems to exert a very marked influence upon the cases, even when the constipation is not severe. It is often wise to administer a full dose of this drug every five or six days. In some patients, a purgative dose of castor oil given every few days, acts more satisfactorily than the calomel. It is sometimes objectionable, however, from its tendency to aggravate the constipation.

Drugs directed toward the process of putrefaction are extremely unsatisfactory even in older children, but sometimes diminution in the amount of flatulence follows the use of salol or salicylate of soda in five-grain doses after meals. General tonics are required, and may add materially to the improvement of the patients. Altogether the best one is nux vomica. It may be given in combination with the bitter wine of iron just before meals, three times a day. This increases the appetite and acts favourably upon the constipation. Cod-liver oil, particularly in the early stage, is badly borne, and aggravates the symptoms. It should be withheld in all cases until very marked improvement in the condition of the digestion is assured.

Relapses are easily excited by indiscretion in diet, and parents should be impressed at the very beginning with the necessity of adhering rigidly to the diet prescribed. It very often happens that the improvement which is seen after one or two months of careful treatment is so marked as to lead the parents to the belief that a cure has been accomplished, so that they relax their vigilance and allow improper articles of food—conditions which are almost certain to induce a relapse. If the case is an aggravated one, and the symptoms of long standing, it is wise to tell parents at the outset that a year's treatment is the minimum in which anything permanent can be accomplished.

The general treatment of the patient must not be overlooked. Proper clothing, regular exercise in the open air, cool sleeping rooms, sponging every morning with cold water, are all of very great importance, and contribute almost as much to the results obtained as the local measures adopted. (See chapter on Malnutrition.)

The improvement in the nervous symptoms of the patient is one of the first things noticed, and is often marked in a few days after the beginning of treatment. From an irritable, fretful, peevish child the patient is sometimes totally changed in disposition in two weeks, so as to become quiet, affectionate, docile, and playful.

INTESTINAL COLIC.

The term *colic* is applied to any severe paroxysmal pain occurring in the intestines. It may be due to many causes. The colic of lead and arsenic poisoning are both very rare in children; but colicky pains are present in appendicitis, intussusception, ileo-colitis, and, in fact, in all the severe forms of intestinal inflammation. Colic may be due to swallowing certain substances, especially foreign bodies and the seeds of fruits; and in rare cases it may be excited by the presence of round worms when they are numerous. In all the conditions mentioned, colic is only one of the symptoms, although it may be a very prominent one.

The special and peculiar colic of infancy is that which is associated with flatulence, and is due to indigestion. Here it is a symptom only, but may be a most troublesome one. This form of colic belongs essentially to the first six months of life, and is more frequent during the first three months. It may be seen at any time when digestion is very feeble. Many young infants suffer from colic a large part of the time; others have only occasional attacks, which are often repeated at a certain time in the day.

The flatulence to which the colic is usually due, may be from decomposition in the food or intestinal secretions, or in both. It is seen quite as often in nursing infants as in those who are artificially fed. Any of the elements of the milk may be a cause of colic, but in fully four fifths of the cases it is the proteids. The colic of nursing infants is nearly always due to the fact that the milk is excessive in proteids, or else that these are digested with special difficulty. If cow's milk is the food, it is the casein which is usually at fault. It is rare that the quantity of sugar present in cow's milk is sufficient to be a cause of colic; but this may happen when sugar has been added, much more frequently with cane sugar than with milk sugar. It is extremely rare for the fat to be a cause of colic. In infants, whose food consists largely of farinaceous substances, colic is also very common.

As a result of the decomposition taking place in the intestine, gas accumulates, and, the intestines lacking sufficient muscular force to expel it, distention follows. To this in part the pain is due. But spasm of the muscular walls of the intestine is also an element in producing the pain. In some of the most severe cases it is possible that the spasm may be accompanied by a slight intussusception. Colic may occur without flatulence, as in cases when it follows cold feet or chilling the surface. In these cases also, muscular spasm appears to be the principal factor in causing the pain. Intestinal colic may occur alone, or it may alternate with or accompany gastric colic.

Symptoms.—These are in most cases so typical as to be easily recognised. They are always more severe in delicate and highly-nervous children. In the severe attacks there are contraction of the features, the loud paroxysmal cry, subsiding for a few moments and then beginning with renewed intensity, drawing up of the lower extremities, and in male infants contraction of the scrotum. With these symptoms the abdomen is usually found tense and hard. With the expulsion of the gas, the symptoms subside at once, and the child usually falls asleep. In the most severe attacks there may be considerable prostration, cold extremities, and perspiration. When the symptoms are less severe there is only continual fretfulness, and the child can not sleep. When colic is habitual there are very few hours in the twenty-four when the child seems to be entirely comfortable. In nursing infants there may at times be difficulty in distinguishing the cry of colic from that of hunger, as infants suffering from colic will usually take food eagerly, and this is often followed by temporary relief. In colic, however, the pain soon returns, and often is more severe than before. The cry of colic is usually violent and paroxysmal; that of hunger is apt to be prolonged and continuous, and is not accompanied by the other symptoms mentioned as indicating abdominal pain. In older children the less frequent causes of colic mentioned at the beginning of this article, especially appendicitis, should be borne in mind.

Treatment.—When colic is due to flatulence of the intestine, nothing given by the mouth has much effect in relieving the symptoms. Certainly food should not be given. The purpose of treatment during the attack is to assist the child to get rid of the gas; as this is usually in the colon, the most efficient means is by enemata. At first an injection of four or five ounces of lukewarm water should be used. If this is not successful, two ounces of cold water with half a teaspoonful of glycerin may be tried. This rarely fails to start peristalsis and expel the gas. In conjunction with these measures, dry heat should be applied to the abdomen by means of hot flannels or a hot-water bag, and the feet should be well warmed. In cases of colic not associated with flatulence, where the pain is probably the result of muscular spasm, opium in some form is required in addition to heat or counter-irritation. The treatment between the attacks and the treatment of habitual colic should be directed toward the indigestion, upon which they depend.

CHRONIC CONSTIPATION.

Constipation may be said to exist whenever the stools are less frequent, harder, and drier than normal. During the first six months infants usually have two movements a day. Many, however, have only one; but if this is normal in character the child is not constipated. In other cases, although there are two and even three stools a day, they may all be small, dry, and hard, having all the characters of constipated stools, and the case should be treated accordingly.

Etiology.—The causes of chronic constipation are many and far-reaching. It may be due to a diminution in the secretion of the intestinal glands or of the liver. The movements are then hard, dry, very light-coloured, and are associated with much flatulence and other signs of intestinal indigestion. Very often the principal factor in constipation is insufficient muscular contraction in the intestine. The fæcal masses are then propelled so slowly and remain so long in the intestine that the fluid portion is absorbed, the residue becoming, in consequence, so dry and hard that it is difficult to evacuate. In other cases constipation depends upon the fact that there is insufficient volume to the stools, as may be the case when the food given leaves very little residue. Constipation may depend upon local causes, as, for example, where an evacuation of the bowels is resisted on account of pain from fissure of the anus or from hæmorrhoids. Although not the primary cause, this condition may be sufficient to keep up the constipation indefinitely. It may, in rare cases, be due to a congenital condition, such as a narrowing of the large intestine at some point. The most important causes of constipation may be grouped under two heads: diet, and conditions giving rise to muscular atony.

Diet.—In breast-fed infants the trouble is usually a lack of fat and an excess of proteids in the milk. In those who are artificially fed it is often because the fat is too low, and sometimes because both the fat and the proteids are too low, the stool lacking volume. In other cases the cause of constipation is indigestion, in still others the use of "sterilized" milk. During the second and third years the cause may be too much cow's milk, particularly that which has been boiled, or the use of an excessive amount of starchy food. As during the first year, the trouble with cow's milk is that it contains too much casein, the digestibility of which has often been rendered more difficult by the boiling. In older children the cause may be an excess of starchy food and a lack of sufficient green vegetables, meat, and fruit.

Muscular atony.—The most common cause of muscular atony is habit; in a large number of cases this is the principal, and often it is the only factor. If the inclination to have a stool is regularly disregarded it soon ceases to be felt. The ordinary irritation from fæcal masses produces no effect whatever. The longer such a condition continues the more obstinate does it become. This is an important factor in all cases. Another potent cause of muscular atony is rickets. In this disease the muscular walls of the intestine suffer like the muscles of the extremities, and become incapable of doing their work. Again, any form of malnutrition in which there is feeble muscular tone may cause or aggravate constipation. It is often seen as a sequel to acute attacks of diarrhœal diseases, particularly when these have been prolonged. Want of sufficient muscular exercise is a frequent cause. There are many children who rarely suffer from constipation in summer when they have plenty of out-of-door exercise, who very often do so in winter when such exercise is wanting. A loss of muscular tone is not an infrequent result of the prolonged and indiscriminate use of purgative drugs or enemata.

Symptoms.—In some cases no symptoms are present except the local ones, the general health being excellent and the nutrition in no way disturbed. In the majority, however, there are symptoms of greater or less severity, depending somewhat upon the cause of the constipation. There may be simply flatulence and colicky pains, or the irritation of the hardened fæcal masses may produce a slight catarrhal inflammation of the sigmoid flexure and the rectum, so that mucus and even traces of blood may be passed with the stool. Hæmorrhoids may develop even in infancy, and frequently the constant straining leads to the production of hernia. In many of the most obstinate cases there are from time to time nervous symptoms resulting from the absorption of various toxic materials from the intestine. There may be headache, dulness, fretfulness, disturbed sleep, and often associated signs of intestinal indigestion. The urine often contains indican in considerable quantity, and there may be slight fever. This is more likely to be present in infants than in older children. In many cases it is hard to separate the symptoms due to the constipation from those which depend upon the indigestion with which it is associated.

Diagnosis.—This includes the discovery of the cause and the principal seat of the constipation. To arrive at the former the most careful and thorough investigation should be made of the child's diet and habits. It is not always possible to determine whether the seat of trouble is the rectum, the upper part of the colon, or the small intestine; but there are some symptoms that will aid us. If a suppository is almost immediately followed by a stool nearly or quite normal in character, one may be sure that the rectum only is at fault, and that it needs but a little extra stimulus to make it do its work. This is a very common condition in infants who are too young to make any voluntary efforts to have a stool. In such cases there are no other symptoms present. In others, the white or gray stools, marked flatulence, offensive breath, and general irritability, leave no doubt of the fact that the trouble is in the small intestine and depends upon indigestion.

Prognosis.—This depends altogether upon the cause of the constipation, and upon how completely circumstances will admit of its being removed.

Treatment.—This is always difficult, and in obstinate cases must be continued for a long time. It is absolutely indispensable to have the co-operation of an intelligent mother or nurse. To establish the habit of regular stools should be the first step, for without this regularity nothing can be done. In infancy this can generally best be accomplished by suppositories. An older child must be taught to heed the first impulse to evacuate the bowel. Regular habits can hardly be formed unless the same time each day is chosen for the movement. That to be preferred is soon after the morning meal, as taking food into the stomach usually starts a peristaltic wave which is continued throughout the intestine, and of this advantage must be taken. Even in infants only a few months old the habit of regular stools is often easily formed if the child is put upon the chamber or chair invariably at the same hour. This will do much to prevent the formation of a constipated habit. In older children nothing should be allowed to interfere with the movement of the bowels. Breakfast should be early enough to allow ample time for this duty before the other engagements of the day. All children must be carefully watched in this respect, and nurses should be impressed with the importance of the early formation of proper habits.

Food.—With nursing infants who get good breast-milk constipation is rare. Where the milk is low in fat and high in proteids, constipation is not uncommon. For the measures by which such milk can be improved, see page 164. Where the fat can not be increased by dietetic treatment of the nurse, the infant may be given immediately after nursing, from one half to two teaspoonfuls of cream, according to the degree of constipation.

In feeding cow's milk, constipation is overcome by getting the exact proportions of casein and fat which are suited to the infant. With most infants during the early months from 2 to 3 per cent fat and 1 per cent casein succeed best; with those a little older, from 3 to 4 per cent fat and 1·5 per cent casein. During the last half of the first year 4 per cent fat and from 2 to 3 per cent casein will be found satisfactory. (See pages

174–176.) However, to feed a young infant upon 2 per cent fat and 2 per cent casein—which is what is usually given when cow's milk is simply diluted once with water—almost invariably produces constipation. With most infants during the first year, constipation may be, if not cured, at least prevented by such a modification of the milk. This is generally easy if proper feeding is begun early; but when the constipated habit has become firmly established a proper adjustment of the elements of food is often not sufficient.

During the second year, children who suffer from constipation should have both cream and water added to the milk, so that, instead of the 3·5 per cent fat and 4 per cent casein of plain milk, they get 4 per cent fat, and 3 per cent casein. (See formula IX, page 185.) These proportions can be obtained by adding two tablespoonfuls of cream to two thirds of a glass of milk, and filling up the glass with water. Further improvement may be brought about by reducing the quantity of starchy food, and adding more meat or beef juice, which is quite laxative on account of its salts. Fruits are valuable in all these cases; baked apples, oranges, stewed prunes, grapes—especially the hothouse variety—and in summer, fresh peaches, plums, and pears, may be given in small quantities; but all berries should be avoided.

For older children who are upon a mixed diet the amount of starchy food should be moderate, oatmeal being perhaps the best cereal. Milk should be given rather sparingly, and even then may be advantageously modified as for the second year. It is sometimes advisable to stop milk altogether and give only cream, from four to eight ounces of which may be allowed daily. It may be used with the breakfast cereal, mixed with potato or rice, added to soups or broths, and taken in various other ways. All bread should be made from whole wheat or unbolted flour. Meat may be allowed freely, also all green vegetables, one of which should be given every day. All fruits allowed infants may be used, but in larger quantities, and in addition raw apples. Of the dried fruits, only dates, prunes, and figs are admissible, and these are better stewed than raw. Fresh fruit is preferably given in the morning, oranges being especially useful when taken on rising.

Either hot or cold water, when taken an hour before breakfast, may be of considerable benefit to older children. The sparkling waters, like Vichy or Apollinaris, are often better than plain water.

Massage, when properly employed, is useful in conjunction with other measures, but rarely succeeds alone. It should be given for five or ten minutes after retiring and just before rising. The hand must be warm, but no oil used, the purpose being not to make friction upon the skin, but to move the skin and abdominal walls upon the intestines. This should be done with a circular motion, changing the point from time to time until the whole abdomen has been thoroughly covered. In addition to this a general kneading of the abdomen may be employed. Only slight pressure should be made until the child becomes accustomed to the process, when quite deep pressure will be tolerated. The intestinal coils may often be felt contracting under the hand during massage.* In general torpor of the intestines massage is useful, and when properly done may affect the small as well as the large intestine.

A proper amount of active muscular exercise is necessary and should be made a part of the treatment in every case. Yale (New York) has called attention to the importance of posture during the stool, he having found that in many cases a cure was effected simply by substituting a low seat on a nursery chair or closet for the high one previously used. The low seat afforded the child an opportunity to strain to some purpose, while the higher one with the legs dangling, made this almost impossible.

Suppositories.—In many cases, particularly in young infants who are not old enough to initiate the muscular effort, a slight stimulus to the rectum is all that is required. The cone of oiled paper has a great reputation in domestic practice and is not objectionable. It may be of assistance in establishing the habit of a daily movement at a regular time. Soap suppositories produce a more marked irritation; although their immediate effect is quite satisfactory, they should not be continued indefinitely. They are, however, less objectionable than glycerin suppositories. The latter, for an immediate effect, are convenient and usually efficient; but their prolonged use, especially in infants, is likely to set up a catarrhal proctitis. The gluten suppositories produce less irritation and are consequently slower in their effect, but they have not the disadvantages of the soap or glycerin. Medicated suppositories are certainly one of our most efficient measures; if drugs must be employed, they are perhaps open to the fewest objections when used in this way. The following are the best drugs for this purpose, the dose being that for a child of two or three years: ext. nux vomica, gr. $\frac{1}{12}$; ext. belladonna, gr. $\frac{1}{24}$; ext. hyoscyamus, gr. $\frac{1}{24}$; sulphur, gr. ij; purified aloes, gr. $\frac{1}{4}$; aloin, gr. $\frac{1}{24}$. A good combination is aloin, gr. $\frac{1}{24}$; ext. belladonna, gr. $\frac{1}{24}$; ext. nux vomica, gr. $\frac{1}{12}$; ol. theobrom., gr. x. In obstinate cases this may be used night and morning, and later at night only. After some improvement has occurred the aloin may be omitted. Many of the proprietary suppositories contain the ingredients mentioned, particularly belladonna, the dose of which is often considerably larger than should be given. Suppositories are most useful where the seat of trouble is the rectum and lower colon; but very little is to be expected from them when it is in the small intestine.

Enemata.—These should be restricted to cases in which only temporary relief is desired. An injection of an ounce of sweet oil may facilitate the passage of very hard and dry stools, and larger injections of soap and water may be used to break up hard fæcal accumulations. For immediate effect an injection of one drachm of glycerin in half an ounce of water is perhaps the most efficient means at our command. Cases of fæcal impaction are rarely met with in children. They are to be managed as in adults, by repeated injections of warm water or of ox-gall, and sometimes by mechanical removal. For continuous use enemata are not to be advised, for larger and larger quantities are required to produce the effect.

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* See Karnitzky, Archiv für Kinderheilkunde, Bd. xii, p. 66.

Medicinal treatment.—This is the least important part of the management of chronic constipation. No plan is worse than to give some active purgative every third or fourth day and trust matters to take care of themselves the rest of the time. The most valuable drugs are those which stimulate the muscular walls of the intestine, such as cascara, nux vomica, belladonna, and hyoscyamus. These are particularly useful in atonic constipation associated with rickets and following diarrhœal diseases, but they are valuable in all cases. With most drugs the prolonged use of small doses is better than the occasional use of large ones. Calomel is indicated in cases attended with dry, very white stools and marked flatulence; one fourth to one half grain of the tablet triturates may be given for two or three successive nights in conjunction with other means. Cascara may be used either in the form of the elixir, dose from one half to one drachm, or the fluid extract, from one to five drops. Rhubarb, either in the form of the syrup or the mixture of rhubarb and soda, may be given occasionally, but it is not adapted to continuous use. Of salines, phosphate of soda is best for continuous use in infants. All the preparations of malt possess slight laxative properties, and are useful in conjunction with dietetic and other medicinal means; either Trommer's extract of malt or maltine may be employed. Castor oil should seldom be given for chronic constipation. The frequent use of small quantities of olive oil is often a good means of treatment in the case of young infants, the oil being added to the food.

Summary.—The treatment of constipation is palliative and curative. The palliative measures are drugs, suppositories, injections, and enemata. Cure is accomplished only by diet, massage, exercise, and the formation of regular habits. An average case of chronic constipation in a child four years old may be managed as follows: Massage for eight minutes, morning and night; the juice of half an orange and a glass of Vichy immediately upon rising; a breakfast of oatmeal with one ounce of cream, dried bread with butter, an egg, half a glass of milk with cream and water added; a dinner of soup, one starchy vegetable—e. g., potato with cream, and one green vegetable, beef-steak, baked apple or prunes, dried bread and butter, and water to drink; for supper, cream-toast, egg, dried bread and butter, or Graham crackers, half a glass of milk with cream and water added; a suppository containing nux vomica and hyoscyamus given at bedtime.

Hypertrophy and Dilatation of the Colon.—It is probable that in many cases of chronic constipation, especially among rachitic infants, a considerable degree of dilatation of the colon occurs. However, it seems to be but a temporary condition, disappearing by the third or fourth year.

There is another form of dilatation which may be permanent; it is associated with a marked degree of hypertrophy of the muscular walls of the colon. The reported cases thus far are few in number, but have been observed both in infants (Hirschsprung,* Mya †) and in older children (Osler, Hughes ‡). The prominent symptoms are two: obstinate constipation, which in most of the cases has continued from early infancy, and is sometimes so severe that the patients have gone for two weeks without a movement of the bowels; and distention of the abdomen, which may be extreme, but which may disappear and the abdomen become perfectly flat after the fæces and flatus have been discharged. There is usually emaciation, and from time to time there may be diarrhœa. Death may occur in infancy, or the patients may live to adult life.

In the cases which have come to autopsy there has been found an enormous dilatation of the large intestine, chiefly of the transverse colon and the sigmoid flexure. In one case (Hughes'), in a boy of three years, the colon was four inches in diameter, and held fourteen pints of water. In none of the cases was there stricture at any point. The mucous membrane has invariably been found ulcerated, this clearly being a secondary process. The muscular walls have been greatly hypertrophied. The condition is without doubt a congenital one. Treatment is palliative only. In some of the cases the condition seems to have been aggravated by the use of large enemata.

INTUSSUSCEPTION.

Intussusception consists in the invagination of one portion of the intestine into another. It occurs most frequently in infancy, being at this age the most common cause of acute intestinal obstruction. The accident is not a common one, but the life of the patient generally depends upon its prompt recognition.

Varieties.—Usually the upper part of the intestine is invaginated into the lower, although the reverse is occasionally seen. Intussusceptions may occur at any point in the intestinal tract. Those of the small intestine are called *enteric*; those of the colon, *colic*; and those occurring at the ileo-cæcal valve, *ileo-cæcal* (Fig. 60). Of 90 cases under ten years of age, in which the variety was determined by autopsy or operation, 75 were ileo-cæcal, 9 colic, and 6 enteric. In the ileo-cæcal form a few inches of the ileum pass through the ileo-cæcal valve, and then invagination of the colon occurs. Cases in which the ileum passes through the valve, but without invagination of the colon, are sometimes classed separately as an *ileo-colic* variety.

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* Hirschsprung, Jahrbuch für Kinderh., Bd. xxvii. p. 1.

† Mya, Revue Mensuelle des Maladies de l'Enfance, vol. xii, p. 633.

‡ Osler, Archives of Pædiatrics, vol. xi, p. 112.

Intussusceptions of the dying, as they have been called, are met with in my experience in about eight per cent of all autopsies made upon infants; they are not often found in children over two years of age. They are distinguished by the fact that they are always descending, enteric, and multiple—usually from eight to twelve invaginations being present. They are more frequently in the jejunum than in the ileum. They usually involve but two or three inches of the intestine, but may include ten or twelve inches. They are found in autopsies upon patients dying of all varieties of disease, and are probably produced in the death agony. These intussusceptions are without symptoms, and are of no clinical importance.

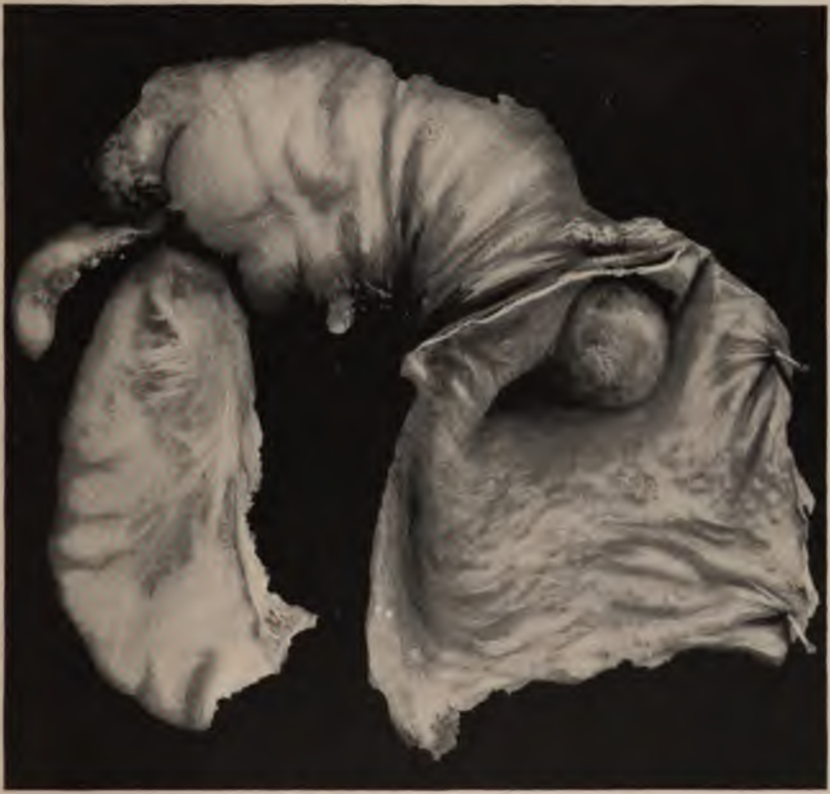

FIG. 60.—Ileo-cæcal intussusception. A specimen removed from a child in the New York Infant Asylum.

Etiology.—Of 385 collected cases under ten years, the following are the ages reported: under four months, 28 cases; from four to six months, 113; seven to nine months, 71; ten to twelve months, 18; one to two years, 32; two to ten years, 96. Three fourths of the cases which occur in childhood are, therefore, in the first two years, and one half of them between the fourth and ninth months. The greater frequency in infancy is attributed to the thinness of the intestinal walls, the greater mobility of the cæcum and ascending colon, and the presence of other intestinal derangements at this age.

Males are more often affected than females. Of 268 cases in which the sex was mentioned, there were 174 males and 94 females. For this fact there is no explanation. The exciting causes of an attack are extremely obscure. The great majority of cases occur in children who were apparently in perfect health. Some previous intestinal disorder was present in about three per cent of the cases I have collected—diarrhœa, dysentery, colic, chronic indigestion, and constipation, all being mentioned. In four cases the intussusception was ascribed to injury of the abdomen. The association with the general diseases is too infrequent to be of any importance.

Lesions.—Nothnagel's vivisection experiments * have shown conclusively that intussusceptions are formed by the irregular action of the muscular walls of the intestine. They can be produced or released at will by varying the application of the electrical current. In the artificial intussusception there is first a contraction of a certain part of the intestine, and if this ceases abruptly the normal gut below this point turns upward and folds over upon the contracted portion, thus forming a minute intussusception (Fig. 61). When once begun, the intussusception increases solely at the expense of the external layer (Fig. 62). Thus, while the apex of the tumour D remains unchanged, the part of the sheath at A passes to B and then to C, so that the lower part of the intestine is drawn over the upper, rather than the upper crowded into the lower. The mechanism of the invagination was apparently the same when a part of the intestine was first paralyzed by

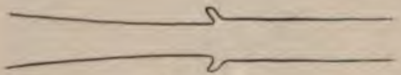
FIG. 61.

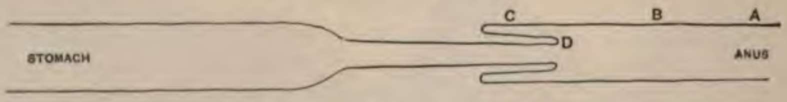

FIG. 62.—Mechanism of intussusception. (Treves.)

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* Beiträge zur Physiologie und Pathologie des Darms, Berlin, 1884. A full abstract is to be found in Treves's Intestinal Obstruction, London, 1884, to which I am indebted for many points in this article.

crushing, as in the cases in which a spasm of the intestine was first produced.

There is no doubt that pathological intussusceptions are produced in the same way as in these experiments. As the invagination takes place, the mesentery is drawn in with the bowel, and always lies between the sheath and the inner layer. To allow intussusception to occur, the mesentery must be unduly long, stretched, or lacerated. Its attachment to the spine causes the intussusception to describe an arc of a circle, the concavity of which is always toward the spine. It also causes a puckering of the tumour. Invagination does not necessarily produce either obstruction or strangulation, but usually both are present, and are the chief causes of the symptoms. Traction upon the mesentery leads to obstruction in its vessels, causing congestion, œdema, hæmorrhages, and even gangrene. Obstruction is chiefly due to swelling. It may be due to dragging of the mesentery, which brings the apex of the tumour against the side of the gut, or to bending of the intussusception.

The great cause of irreducibility in the first two or three days is swelling. I have several times seen at autopsy or operation the intussusception easily reduced, except the last two or three inches of the cæcum or ileum, which was swollen to the thickness of from a fourth to half an inch. Adhesions may prevent reduction, but rarely before the fourth day; they are often absent as late as the sixth or seventh day. They are usually between the internal and middle layers of the intussusceptum, and are due to local peritonitis. In chronic cases, however, they form the principal obstacle to reduction. Other causes of irreducibility are twisting of the tumour and pinching of the prolapsed intestine, especially of the ileum by the ileo-cæcal valve.

Gangrene and sloughing of the gangrenous portion of the intestine occur much more often in acute than in chronic cases. Portions of intestine were passed *per anum* in 24 of 362 cases under ten years, or about six per cent; but only two of these were in infants. Toward the end of the second week is the time when the separation of the sloughs is to be looked for. The amount of intestine discharged, varies from a few inches to several feet. Two cases are on record in which the entire colon was passed, the patients recovering, but dying several months later from other causes. At the autopsies the ileum was found attached to the lower part of the rectum just above the anus. In acute cases gangrene occurs about the upper end of the tumour, and the intestine usually comes away in one large mass. In chronic cases shreds of intestine may be discharged for several weeks.

Symptoms.—The clinical picture of a case of intussusception is a striking one, and when acute the symptoms are so uniform that, once seen, they can scarcely be overlooked a second time. The patient, usually between six and twelve months of age, is taken suddenly ill with severe pain and vomiting; the pain recurring paroxysmally every few minutes, and the vomiting being first of the contents of the stomach, and afterward bilious. There may be one or two loose fæcal stools, then only blood or blood and mucus are passed without any admixture of fæces. The general symptoms are those of great prostration, or even collapse—pallor, feeble pulse, apathy, and normal or subnormal temperature. The abdomen is relaxed. A tumour is present in the left iliac fossa, or it is felt *per rectum*. Later there is tympanites; the vomiting and pain continue; there is a steady increase in the prostration, and toward the end a rapidly rising temperature, which may reach 105° or 106° F. before death occurs from collapse. If the symptoms continue longer the signs of peritonitis are added. In subacute cases the onset is less abrupt, and pain, vomiting, and constipation less constant and less severe; but the same symptoms are present. In chronic cases the onset is with vague, indefinite intestinal symptoms; pain, vomiting and bloody discharges are usually wanting; there are progressive wasting and more or less diarrhœa, but only the presence of the tumour leads to the recognition of the disease.

Onset.—Of 193 cases under ten years in which data upon this point could be obtained, the onset was sudden in 181 and gradual in 12 cases. By far the most frequent symptoms of onset are pain and vomiting. In a smaller number of cases the initial symptom is diarrhœa or a discharge of blood and mucus.

Pain.—This is rarely continuous, but is intermittent, recurring in paroxysms like those of ordinary colic, but of great severity. No pain in infancy is to be compared with it. The child often shrieks so as to be heard all over the house. Pain is a prominent symptom in over three fourths of the cases, and is very rarely absent. It is generally more marked for the first two days, but may continue throughout the attack. In a few cases the pain is localized, being usually referred to the region of the umbilicus.

Vomiting is more marked at the onset, but may continue throughout the disease. Like pain, it is more frequent in the acute cases. It is due to intestinal obstruction. Vomiting is present in fully four fifths of all cases. Usually it is persistent and uncontrollable; it is often projectile. If food is given, vomiting often occurs as soon as it reaches the stomach. Stercoraceous vomiting occurs in about fifteen per cent of the cases in children under ten years, but is not common in infancy. It is rarely present before the third or fourth day. Although a bad sign, it is not by any means a fatal one, as nearly one half the cases in which it has been noted have recovered; it is to be regarded as indicating complete intestinal obstruction rather than strangulation.

Tumour.—This is one of the most important symptoms for diagnosis because of its frequency and its peculiar character. It is present early in the disease, often in a few hours after the initial symptoms. The following table shows the frequency with which a tumour was present in the different varieties, and the position which it occupied in each. The anatomical variety was determined either by autopsy or operation.

The Relation between the Tumour and the Different Varieties of Intussusception in 188 Cases under Ten Years.

SEAT OF TUMOUR.	SEAT OF INTUSSUSCEPTION.					
	Ileo-cæcal.	Ileo-colic.	Colic.	Enteric.	Not stated.	Total.
Region of cæcum	..	3	..	1	7	11
" " ascending colon	1	..	..	..	12	13
" " transverse colon	3	..	..	..	13	16
" " descending colon	3	..	..	..	18	21
" " sigmoid flexure	4	..	1	..	8	13
Rectal	25	1	7	..	28	61
Protruding from anus	9	..	1	..	12	22
Umbilical region	..	..	..	1	..	1
Movable	..	..	..	1	2	3
Site unknown	1	..	..	..	..	1
Total	46	4	9	3	100	162
No tumour felt	10	2	..	1	13	26

Tumour was thus made out during life in eighty-six per cent of the cases; and in the great majority of these it was discovered at the first careful examination.

It will be noted that in one half of the cases the tumour was either felt in the rectum or protruded from the anus, and that in over two thirds it had advanced as far as the descending colon or beyond. The tumour may reach the rectum in a surprisingly short time, even when the invagination begins at the ileo-cæcal valve. In one of my own cases it was felt in the rectum in less than twelve hours from the onset. The usual description, "sausage-shaped," is accurate when the invagination is large, the tumour then being from four to six inches long and about an inch and a half in diameter. It is often curved.

During manipulation, or during an attack of pain, the tumour may become more prominent and may be distinctly erectile. To the touch the rectal tumour closely resembles the os uteri, the central opening being the apex of the intussusception. When protruding from the body, the tumour is rarely more than two inches long. It is usually of a deep purplish colour, and may be gangrenous. It has been mistaken for prolapsus ani, polypus, and even hæmorrhoids. In a case which came subsequently under my observation, the tumour was discovered by the mother before the physician had suspected the condition.

Condition of the bowels.—Bloody stools are a very constant symptom. Of 186 cases under ten years in which this condition of the bowels was noted, blood in the stools was present in seventy-six per cent. There are very often two or three thin, diarrhœal movements, and then only blood and mucus are passed with no trace of fæces and with no fæcal odour. The amount of blood varies from a quantity sufficient to stain the mucus to an ounce of semifluid blood. It rarely occurs without some mucus. Such discharges frequently follow attacks of severe colicky pain, and may occur several times in an hour. They may continue, or after a day or two they may be succeeded by absolute stoppage. Diarrhœa throughout the attack is rare in children, particularly so in infants. It belongs generally to chronic cases. Constipation is complete in most of the acute cases, neither gas nor fæces being passed; a fact which the discharge of blood and mucus may lead one to overlook.

Tenesmus is very common if the tumour is rectal. Relaxation of the sphincter is met with in a considerable proportion of the cases when the tumour is in the sigmoid flexure, or rectum.

During the first twenty-four or forty-eight hours the *abdominal walls* are soft and relaxed, and may even be retracted. Usually there is then little resistance to abdominal palpation. After the second or third day there is tympanites; but this does not necessarily mean that peritonitis exists. Localized tenderness is a symptom of some importance when a tumour is absent. Scanty urine has been noted in a few cases, but is of no special value in showing the seat of obstruction.

In the acute cases the *general symptoms* are very striking. They are the ordinary ones of severe shock—marked prostration, pallor with an anxious expression of the face, general muscular relaxation, cold extremities, cold perspiration, and often a subnormal temperature. Early there is marked restlessness, and even convulsions may occur. Later there are apathy, dulness, and semi-stupor. The temperature during the first twenty-four hours is usually not elevated, and is frequently subnormal. Toward the close of the disease it rises rapidly to 103°, 104° F., or even higher, quite independently of peritonitis. A rapidly rising temperature is always a bad symptom, and usually betokens death within twenty-four hours. Wasting is seen in the chronic cases, and may be quite rapid.

Course, Duration and Termination.—Of 198 cases under ten years, 155 were classed as acute, lasting less than seven days; 33 as subacute, lasting from one to four weeks; 10 were chronic, lasting over four weeks. Nearly all the cases occurring in infancy are acute. The duration of the disease in 92 fatal cases was as follows: less than twenty-four hours, 2 cases; two to four days, 44 cases; five to seven days, 22 cases; one to two weeks, 18 cases; two to three weeks, 6 cases. Thus one half the cases died upon the third, fourth, or fifth day. Of 57 cases terminating in recovery, 66 per cent were reduced in the first or second day. (See table, page 386.)

Spontaneous reduction is, without doubt, possible in intussusception.

Treves and others are of the opinion that this happens much more frequently than is generally supposed, and that many cases of severe colic are really cases of slight intussusception. There are seen in both conditions the tendency to vomit, the paroxysmal pain, the constitutional depression, and often the sudden cessation of the symptoms, especially under the influence of opium; but to make a positive diagnosis of invagination in such cases is impossible. Intussusception may be cured spontaneously by sloughing of the invaginated part, the continuity of the intestine being preserved by adhesions. Such a result is rare at all ages, and is almost never seen in infancy. Even though recovery from the attack takes place, complete restoration to health is very rare.

The most frequent cause of death in acute cases is shock. Peritonitis is not found at autopsy or operation so often as might be expected. In 58 autopsies, it was seen but twenty times, and in seven of these it was limited to the intussusception. In but 7 cases was there perforation. In chronic cases death is usually from exhaustion or complications.

Diagnosis.—This usually presents no difficulty in acute cases provided the physician has the condition in mind. The great majority of such cases present nearly all the classical symptoms—viz., sudden onset, recurring colicky pains, frequent vomiting, bloody and mucous stools without fæcal matter, general prostration or collapse, and low temperature. The records show that the most common error is to regard the case for the first few days as one of gastro-enteritis or ileo-colitis, the physician's attention being engrossed by the vomiting and bloody stools. Given the other usual symptoms, the presence of the characteristic tumour is conclusive evidence of intussusception. Unless the patient is very much relaxed, a satisfactory examination is possible only under full anæsthesia. In any case of acute obstruction in infants, intussusception should first be considered. Chronic cases present no diagnostic symptoms except the tumour. In both acute and chronic cases the rectal examination is most important for diagnosis, and often settles the question at once.

Prognosis.—The prognosis of intussusception depends upon the age of the patient, upon the variety of the disease—whether acute, subacute, or chronic—and upon the time when proper treatment is begun.

There were collected by Pilz* in 1870, 94 cases under one year, the mortality being 84 per cent. Of 135 cases of the same age reported between 1870 and 1891 the mortality was 59 per cent. In Pilz's table, of 51 cases between one and ten years of age, the mortality was 68 per cent; while of 82 cases between one and ten years of age, from 1873 to 1891, the mortality was but 46 per cent. Formerly recovery was rare, except in cases of sloughing; but with earlier diagnosis and a better understanding of the proper methods of treatment, the mortality has been very much reduced. Combining the figures of Pilz with my own, there are 362 cases with 231 deaths, or 63·5 per cent.

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* Jahrbuch für Kinderh., Bd. iii, p. 6.

The following table shows the duration of the disease in 57 cases that were reduced either by injection or inflation, or which recovered after laparotomy:

The Duration of Invagination in 57 Acute Cases which were reduced.

Cured on	1st day	by injection,	8;	inflation,	8;	laparotomy,	5;	total,	21 cases.
"	" 2d	"	"	9;	"	6;	"	2;	" 17 "
"	" 3d	"	"	3;	"	0;	"	2;	" 5 "
"	" 4th	"	"	6;	"	5;	"	2;	" 13 "
"	" 5th	"	"	1;	"	0;	"	0;	" 1 case.

In two thirds of the cases, therefore, reduction was effected on the first or second day. After this time the chances of success are much reduced.

Treatment.—In the management of a case of intussusception almost the same rules may be applied as in strangulated hernia—viz., first, a thorough attempt at reduction by mechanical means, with the assistance of taxis, and, this failing, an early resort to laparotomy. Only two methods of mechanical reduction can be relied upon, inflation and injections.

Inflation should always be done under an anæsthetic, unless there is extreme relaxation. The position is not of great importance; preferably the child should lie upon the back, with thighs flexed. From time to time inversion may be practised, to get the assistance of traction of the intestine above upon the seat of invagination. An ordinary hand bellows with a catheter attached is the best apparatus for inflation. It should be done very slowly, and the air prevented from escaping by pressing the buttocks tightly together. It is well to continue a gentle manipulation of the tumour through the abdominal walls during inflation. The amount of air which it is safe to inject must be left to the judgment of the physician. The best guide to the amount which has been introduced is the tension of the abdominal walls. A thorough trial of this method should occupy from fifteen to thirty minutes.

Reduction is sometimes indicated by rumbling sounds, and by the abdomen resuming its normal contour because the whole of the colon is filled, in place of the unequal distention before present. In several instances a distinct change in the expression of the features has been noted. In some cases a gush of fluid fæces has followed disinvagination. Not infrequently all such decisive symptoms are absent, and the physician may be in doubt whether or not reduction has taken place. The air is allowed to escape, best by introducing the catheter high into the colon, so that careful palpation of the abdomen can be made while the patient is still under chloroform. The right iliac fossa should be examined with the greatest care, as it often happens that all the tumour except the last few inches has been reduced, this being impossible because of swelling. If the examination is negative, the question of reduction must be decided by the general symptoms. If vomiting continues, if no gas or fæces pass the bowels, if there is no improvement in the pulse or the general condition, and, most of all, if the temperature rises, it is certain that reduction has not been effected, and a second attempt should be made. In a very acute case two or three hours' delay is all that should be permitted. Inflation may be repeated or an injection of water tried, but in either case consent to immediate laparotomy should be obtained if this effort does not succeed. In cases not so acute, where three or four days have passed without symptoms indicating strangulation, it is admissible to make further attempts at reduction and delay laparotomy a little longer.

Injections of fluids.—The patient is prepared as for inflation and the abdomen manipulated during the injection. Plain water may be used, a saline solution, milk and water, or thin gruel. The other substances possess some advantages over plain water in being rather less irritating. The temperature should be from 100° to 105° F. for the relaxing effect. The fluid is placed in a fountain syringe suspended four or five feet above the patient's bed. The injections should be made through a catheter, the escape of the fluid being prevented as in inflation. From time to time the flow of water should be interrupted, the pressure being maintained continuously. It may be desirable to increase the pressure by raising the syringe to the height of six or eight feet, but more is rarely advisable. The occurrence of reduction during injections is not usually quite so evident as during inflation, and herein consists one of the advantages of the latter procedure. After from ten to twenty minutes the water is allowed to escape, and the abdomen examined. In making further attempts at reduction by injections one should be governed by the same considerations as in inflation.

The choice between inflation and injection depends somewhat upon individual experience. My own preference is for inflation, mainly for the reasons given above, that it is easier to determine whether reduction has taken place both during and after its use. The danger of rupturing the intestine belongs alike to both; but that it is not likely to occur in either is conclusively shown by the fact that in a series of 225 collected cases, all in children, and including nearly all those reported between 1870 and 1891, this accident has been recorded only once. In rare cases the symptoms may continue after reduction. Pick records a case in which laparotomy was done subsequently to inflation, with the belief that reduction had not been effected. No intussusception was found, and the continuance of the symptoms was attributed to paralysis.

The treatment after reduction consists in keeping the patient absolutely quiet and moderately under the influence of opium for two or three days, to allay the excessive irritability of the intestinal walls. The diet should be very light. Cathartics especially should be avoided for several days.

Recurrence of the invagination is not uncommon. It was noted in 13, or about six per cent, of my collected cases under ten years; of this number nine recovered and four died. Recurrence is more likely to happen in the first twenty-four hours after reduction; this was the time in nine of the thirteen cases. It may, however, be as late as a month, rarely later. In one half the cases there was but a single recurrence, but three, four, and even six recurrences in the course of a few weeks have been seen. Ludwig reports a case in an infant eight months old in whom twenty-two recurrences were seen in one month. This was of the colic variety; it could hardly happen in any other form.

Laparotomy is indicated as soon as a thorough trial of reduction by inflation or injection has been made without success. In the very acute cases the operation should not be delayed an hour after such failure is evident. Needless delays have caused death in many instances. The operation should not be looked upon as a last resort in hopeless cases, but as a measure which, if employed reasonably early, offers a fair prospect of success where disinvagination can not be accomplished by any other means. I have collected 72 cases in which the abdomen has been opened for the relief of intussusception in children. In 35 of these the operation was done at so late a period that reduction of the invagination was impossible owing to swelling, adhesions, gangrene, or other causes. In every instance the child died. In the 37 cases in which reduction was effected at the operation, 14, or thirty-eight per cent, recovered. More than half the cases were under one year, and all but three were under two years, showing that early infancy is no barrier to the operation. In over one third of the cases the operation was done in the first twenty-four hours, and in half of them on the first or second day. The time of operation has therefore more to do with the result than any other factor. Of 16 operations in the first and second days there were 7 recoveries, or forty-four per cent. Of 44 operations on or after the third day there were 7 recoveries, or sixteen per cent, and two of these were chronic cases.

Summary.—Cathartics are absolutely contra-indicated in all circumstances. Opium is to be administered as soon as the diagnosis is made, for the relief of pain and to prevent the increase of the intussusception, also in all cases after reduction by mechanical means or operation. Inflation and injection are to be tried successively, preferably under an anæsthetic, combined with manipulation of the abdomen, sometimes with inversion of the patient. Not more than two trials should be made in acute cases. The abdomen should then be opened without an hour's unnecessary delay.

CHAPTER X.

DISEASES OF THE INTESTINES.—(*Continued.*)

APPENDICITIS.

THE terms *typhlitis*, *perityphlitis*, and *perityphlitic abscess* were formerly much used to denote certain forms of inflammation occurring in the right iliac fossa. Of late these terms are but little employed, as it has been shown that these conditions are almost invariably due to disease of the vermiform appendix. The existence of typhlitis as a separate and independent disease is exceedingly rare, if indeed it ever occurs except as a result of fæcal impaction.

Inflammation of the appendix may be catarrhal, ulcerative, or perforative, and it may be acute, chronic, or recurrent.

Etiology.—The predominance of the male sex holds even in childhood. Of 101 collected cases under fifteen years, 72 were males and 29 females. This difference has never been satisfactorily explained. Appendicitis is exceedingly rare before the fourth year, but from this time it is of quite frequent occurrence throughout childhood, especially after the tenth year. Of 104 cases, 3 were under three years, 47 between the fourth and ninth years, and 54 between the tenth and fourteenth years. The youngest recorded case is in a child of seven weeks, reported by Demme. The exciting cause is nearly always a foreign substance; this is usually a fæcal concretion, which is moulded by the appendix into the form of a date-stone, and often regarded as such. Small seeds, however, may form the nucleus of a fæcal concretion, or less frequently they may be the only foreign body. In one of my own cases a pin was found in the appendix, and I have found references to two similar cases. Given the presence of a foreign substance, it is easy to see how inflammation may sometimes be excited by a blow, fall, strain, or other slight accident. Chronic constipation is a factor of considerable importance. The micro-organism usually found in abscesses due to appendicitis is the bacterium coli commune, sometimes associated with other pyogenic germs, but very often in pure culture.

Lesions.—The position of the appendix is extremely variable. It may be found in the pelvis, in the region of the kidney, and sometimes near the umbilicus. This anatomical peculiarity accounts for the variation seen in the situation of abscesses due to appendicitis. According to Treves, the appendix is covered by peritonæum at every point.

Catarrhal appendicitis.—In this form there is thickening of the walls of the appendix from infiltration of its coats with cells. Its communication with the cæcum is temporarily or permanently shut off. The appendix is distended with mucus, pus, and usually some foreign substance, so that it may be as large as the thumb, or even larger. There is congestion of the peritoneal surface. This inflammation may subside without any serious consequence, or it may result in ulceration and perforation. These may follow the first attack, but more frequently not until several attacks have occurred.

Ulcerative or perforative appendicitis.—Ulceration of the appendix may be found in cases of typhoid fever and in tuberculosis. In severe tuberculosis of the intestine I have nearly always found ulcers here. These ulcers rarely perforate, and as a rule they give rise to no clinical symptoms.

The important form of ulceration is that due to an inflammation excited by a foreign body, and this variety is apt to perforate. The inflammation may result in the gradual production of a small perforation by a process of ulceration, or the appendix may be distended by inflammatory products, and gangrene take place with the sudden production of a large opening. The nature of the perforation varies with the intensity of the preceding inflammation. The consequences will depend upon whether this occurs slowly or suddenly, and whether or not the appendix is in such a situation that adhesions readily form. If ulceration takes place slowly, lymph is usually thrown out about the appendix, effectually protecting the general peritoneal cavity. If perforation occurs suddenly, the first effect is usually an intense congestion of the whole peritonæum, and there may even be beginning inflammation. If the situation of the appendix is favourable for the production of adhesions, the inflammation in a very short time is limited by the plastic exudation, and remains as a local peritonitis. If perforation in either of these varieties has carried infectious materials into the peritoneal cavity, there usually results a peritoneal abscess. If not, there is simply a localized plastic peritonitis with adhesions. I have said that these abscesses are in the peritoneal cavity. This is the view which is now almost uniformly adopted, although it was formerly held that the abscesses were extra-peritoneal, being situated in the cellular tissue about the cæcum (perityphlitic abscess). The situation of the abscess will depend upon the location of the appendix. It is usually in the iliac fossa, but may be in the lumbar region or in the pelvis. When left to itself it may open externally, or into any of the neighbouring viscera, usually the rectum; or it may rupture into the general peritoneal cavity, setting up a diffuse peritonitis. Rarely, a large abscess may excite general peritonitis without rupture. If the appendix is so situated that adhesions can not readily form about it, or if these fail or are incomplete, sudden perforation of the appendix excites general peritonitis, usually of a septic variety, which runs a rapid and intense course. Among the secondary lesions which have been met with in children, are suppurative pylephlebitis, abscesses of the liver, general pyæmia, empyema, and pneumonia.

Symptoms.—*Catarrhal appendicitis* in many cases is not diagnosticated. Often, a positive diagnosis is impossible. The symptoms by which it is recognised are local pain, tenderness, and fever; there may also be vomiting and constipation. Both pain and tenderness are moderate, but persist for several days. The tenderness is generally at McBurney's point. The elevation of temperature is usually slight, 100° to 101° F. These symptoms are often so mild that the child makes but few complaints, and is usually up and about. Very frequently they are passed over by young patients without any notice whatever, and recovery may take place without any diagnosis having been made. How frequently such cases occur we have no means of knowing positively, but they are undoubtedly much more common than was formerly believed.

Perforative appendicitis usually follows after several days the somewhat indefinite symptoms of the catarrhal form, the patient perhaps having been hardly sick enough to go to bed. In rare cases the first symptoms may be those of perforation. These are usually severe and characteristic. There is sudden and intense pain in the right iliac fossa, accompanied by vomiting. The pain is acute, lancinating, and continuous; the vomiting is repeated, sometimes being persistent; it is first of the contents of the stomach and then bilious. Occasionally there is a chill. There is always much prostration, and the child from the outset has the appearance of being very seriously ill. With such an onset the disease may follow one of three courses, according as the perforation is followed by localized plastic peritonitis, localized suppurative peritonitis, or general peritonitis.

1. With localized plastic peritonitis.—The symptoms in these cases usually last about a week. They are severe only for the first two or three days, and then gradually pass away. At the onset there are severe pain and tenderness, usually localized in the region of the appendix. There are vomiting, constipation, and slight fever, the temperature being from 100° to 102° F. The temperature gradually falls to normal; the tenderness becomes less acute; and the somewhat diffuse infiltration in the iliac fossa, which was at first present, gradually lessens in area, until there is only a nodular tumour about the size of a hen's egg. This may be slow in disappearing, often lasting for weeks, and sometimes for months. These patients are always liable to recurrent attacks.

2. With localized suppurative peritonitis.—In some of the cases with early symptoms like those above mentioned there is a continuance of the fever, pain, and tenderness, with the rapid formation of an abscess. A distinct tumour may be noticed in the course of two or three days, and pus may be found by aspiration or exploratory incision as soon as the third or fourth day from the onset. At other times the early stage is like that of the cases which terminate in resolution, and marked improvement takes

place after two or three days of severe symptoms. The temperature does not, however, quite reach the normal. After a variable period of quietude, lasting from two or three days to as many weeks, the temperature gradually rises; the pain and tenderness become more severe and are felt over a larger area; the induration, which has been stationary, enlarges and becomes more prominent, and the existence of abscess is unmistakable. In a small number of the cases terminating in abscess the onset is very gradual, without any of the acute symptoms mentioned. It may be accompanied by slight pain only, retraction of the right thigh, and moderate fever. Whether the formation of the abscess is rapid or slow, the subsequent course may be the same. The sac is gradually distended with pus, which may accumulate in immense quantities; as much as five pints have been evacuated. At the present time but few abscesses are allowed to open externally, incision being commonly made before that time. Large abscesses in the lumbar region or in the pelvis, may be mistaken for some other disease, or may be overlooked. Pelvic abscess may be easily recognised by rectal examination. The termination in a single abscess is a favourable one, for with proper surgical treatment these cases almost invariably recover.

3. With general peritonitis.—In these cases the early symptoms of pain, tenderness, vomiting, and fever are followed by those of general peritonitis. The vomiting continues; the tenderness and pain are rapidly diffused over the abdomen; there are constipation, tympanites, and very great prostration. The temperature is variable, and its height is no guide to the severity of the attack; it usually ranges from 101° to 102·5° F., but may be normal or even subnormal. The general prostration is very great; the pulse is rapid and feeble; and in the worst cases there are cold perspiration, hiccough, stercoraceous vomiting, collapse, and death. The duration of these cases may be but two or three days, but it is oftener from five to seven. The symptoms usually go on steadily from bad to worse. Sometimes, after the first intense onset, there may be a lull in the acute symptoms for a day or two, to be followed by a recurrence of the agonizing pain, vomiting, and collapse. Such symptoms indicate that the first perforation was followed by some limiting adhesions, which subsequently gave way, causing all the symptoms of a new perforation. The symptoms of perforative peritonitis may come on late in the disease, when it is due to the rupture of an abscess into the peritoneal cavity. In a small number of cases the early symptoms of perforation are slight, or entirely wanting, the patient passing gradually into a state of great prostration and profound sepsis, with the symptoms of general peritonitis. In a few cases general peritonitis complicates large abscesses without rupture. This termination is the most serious one, and is what occurs in nearly all the fatal cases.

The frequency of the different varieties.—Of 98 cases in children under fourteen years in which the exact variety was known, 10 terminated in resolution, 50 in abscess, and 38 in general peritonitis. These figures certainly do not represent the actual proportion terminating in resolution, for such cases are much more likely to be overlooked, or, if diagnosticated, they are not so commonly reported. Of the cases terminating in abscess, all but six were operated upon; four of these opened into the rectum with a favourable result, one was allowed to open externally, and one caused death by rupture into the peritonæum. From these statistics it would appear that general peritonitis is of more frequent occurrence in children than in adults.

Prognosis.—Of 112 cases, there were 62 recoveries and 50 deaths—a mortality of 45 per cent. General peritonitis was the cause of death in eighty per cent, pyæmia in eight per cent, all of them being protracted cases. The statement has been made (Matterstock, in Gerhardt's Handbuch) that the majority of cases of peritonitis in children terminate fatally within the first three days. This is not borne out by my statistics. Of 43 fatal cases, nearly all of them from general peritonitis, only 6 died during the first three days, 19 from the fourth to the seventh day, 13 in the second week, and 5 in the third week. Recurrent attacks do not appear to be quite so common in children as in adults. They were noted in but two cases of this series.

Cases terminating in the formation of a single abscess usually recover when properly treated. If general peritonitis occurs, whether early or late, the chances of recovery are small. In three cases recovery took place where general peritonitis was stated to be present at the time of operation.

Diagnosis.—The diagnostic symptoms of appendicitis are a sudden severe pain in the right iliac fossa with localized tenderness and vomiting. Persistence of such tenderness is especially significant, as is also an unnatural resistance of the abdominal walls. Constipation is much more frequent than diarrhœa. There is usually some elevation of temperature, but rarely high fever. The catarrhal and perforative forms can not always be distinguished from each other. In some of the catarrhal cases the onset may be sudden and severe, while, on the other hand, perforation may take place without any of its characteristic symptoms. The exploring needle, it is now generally agreed, should be used only when a tumour is present.

Appendicitis may be confounded with colic, indigestion, and, in infants, with intussusception; in older children, with abscesses due to psoitis. Colic is distinguished by the absence of localized tenderness and fever, by its short duration, and by the fact that the pain is generally less intense. Severe colic in older children should, however, always be regarded with suspicion. From acute indigestion the diagnosis is often difficult at the onset, and it may be impossible for twenty-four hours. Very many of the cases of appendicitis have been regarded in the beginning as attacks of indigestion. Here, however, the pain is rarely so severe, but in children the fever is higher. The pain is not usually localized; and, if so, it is more apt to be in the epigastrium or at the umbilicus. But it should be remembered that the pain is not always localized in appendicitis. The presence of pain, vomiting, and localized tenderness, and the greater severity of the constitutional symptoms, indicate appendicitis. Indigestion is more likely to be accompanied by diarrhœa than by constipation, while the opposite is true of appendicitis.

I have twice known pneumonia at the right base to be mistaken for appendicitis. There was severe localized pain in the iliac fossa, which was evidently to be explained by pleurisy implicating the lower intercostal nerves.

Intussusception, from its intense pain, colic, and vomiting, may suggest appendicitis, but it is very rare except in infants. Tenesmus and bloody stools are very constant; the temperature is not elevated in the beginning; if a tumour is present it is usually in the left side of the abdomen.

Between the various forms of local suppuration in the right iliac fossa and appendicitis the diagnosis is rarely difficult. It should always be borne in mind that acute or subacute suppuration in this region is usually due to appendicitis. Abscesses, however, should not be confounded with those due to Pott's disease, or with a psoitis, which is, however, generally traumatic and accompanied by deformity due to the retraction of the thigh, which may be so severe as to lead to the diagnosis of hip disease. The constitutional symptoms of appendicitis are wanting.

Treatment.—Absolute rest in bed should be insisted upon in every case, no matter how mild it may appear, and all patients should be closely watched. As a local application the ice-bag is to be preferred, unless strongly objected to by children, when hot fomentations should be substituted. Morphine should be given in sufficient quantities to relieve pain, but the effect should not be carried further than this. An unnecessary use of opium is objectionable, as obscuring important symptoms. The colon should be kept empty by the daily use of large enemata. All cathartics are to be avoided. Blisters, though formerly so much in vogue for the purpose of promoting resolution, with the better understanding of the nature of the disease, are now very seldom employed.

Appendicitis is in the great majority of cases a surgical disease, and surgical advice should be sought early. It is undoubtedly true that in the past many lives have been needlessly sacrificed because surgical interference was too late resorted to. Operation is clearly indicated in two conditions: first, as soon as there is positive evidence of the existence of abscess; secondly, when the symptoms point to perforation into the general peritoneal cavity. In such cases immediate operation should be done, as offering the only chance of recovery. Regarding other cases surgical opinion is at the present time divided. One group of surgeons advise exploratory incision in every case as soon as the symptoms are definite enough to indicate the existence of appendicitis, whether catarrhal or ulcerative, with the hope of anticipating sudden perforation with its resulting dangers. There is no doubt that by these surgeons a good many cases will be operated upon which might terminate in resolution. But it is claimed first, that the dangers of the operation *per se* are at the present time very slight, while in cases which resolve the danger of subsequent attacks is always present; and secondly, that we have no means of knowing which of these cases may suddenly develop symptoms of perforative peritonitis. The other group of surgeons advocate deferring operation until there is evidence of the formation of pus, except when symptoms point to perforation into the general peritoneal cavity. It must remain for future experience to decide which of these two plans will receive the general sanction of the profession. Regarding recurrent attacks of appendicitis opinion is also divided. For the details of the surgical management the reader is referred to surgical works.

INTESTINAL WORMS.

Judging by published reports, intestinal worms are much more common in Europe than in this country. In 10,000 patients treated for medical diseases in my dispensary service, there was positive evidence of worms in but 79 cases. Of these, 9 had tapeworms, 40 roundworms, 27 threadworms, and 3 both round and threadworms. In private practice among the better classes, worms are certainly rare. I have not seen more than a dozen cases in ten years.

Cestodes—Tapeworms.—Cestodes are usually introduced into the body by the ingestion of some form of food containing larvæ (cysticerci). The larva of the *tænia solium* is most frequently found in pork; that of the *tænia mediocanellata* in beef; that of the *bothriocephalus latus* in fish; that of the *tænia cucumerina* inhabits dog or cat lice, being introduced into the intestinal tract accidentally by the hands.

In the intestine the larvæ develop into the mature tapeworms, usually in from three to three and a half months; after which the terminal segments becoming mature, separate, and are discharged in the fæces, sometimes singly, sometimes connected. New segments continually form next to the head as the terminal ones are cast off, so that the length of the worm is not diminished. The duration of life of the worm is estimated to be from ten to thirty years. Each mature segment is provided with both male and female sexual organs, and contains ova in great numbers. The ova escape after the rupture of the segment outside the body. They find their way into the stomach usually of herbivorous animals with their food. Here the thick shells of the ova are dissolved by the gastric juice and the embryo set free. By means of the hooklets with which it is provided, it migrates from the stomach or intestine and may be found in the muscles or in any organ of the body, even the brain and eye. When it reaches its final resting place it loses its hooks and gradually becomes transformed into a vesicle, from the inner surface of which there projects something resembling the head of the future tapeworm. In this stage it is known as the bladderworm or cysticercus. The cysticerci of the *tænia solium* are sometimes found in man, but the other varieties very rarely. For the further development of the larval form it must be taken into the stomach of man or some carnivorous animal. This occurs when pork, beef, or fish containing cysticerci is eaten. The vesicle wall is now dissolved, and the head passing into the intestine develops into the mature tapeworm. Several varieties of tænia are found in the human intestine:

Tænia Saginata or Mediocanellata—Beef Tapeworm (Fig. 63). This is the most frequent form found in children, all others being rare. Infection results from eating raw or partially cooked beef containing cysticerci. The worm is from twelve to twenty feet in length, and has a square pigmented head without hooks but provided with four suckers. The full-sized segments are from one half to three fourths of an inch long and about half as wide.

Tænia Solium—Pork Tapeworm (Fig. 64). This is a rare form in children, and comes from eating raw or partially cooked pork or sausage. It is from six to ten feet in length, the segments being nearly square. The head is about the size of a mustard seed and is pigmented. It also is provided with four suckers and a proboscis, surrounding which is a circle of about twenty-six hooks.

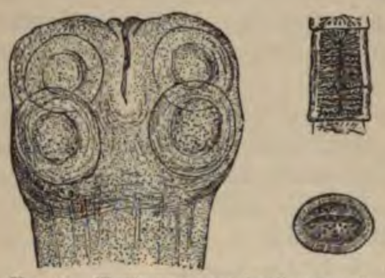

FIG. 63.—Tænia saginata; head, segment, and egg. (Jaksch.)

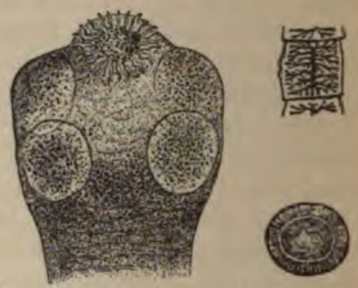

FIG. 64.—Tænia solium; head, segment, and egg. (Jaksch.)

Tænia Cucumerina or Elliptica (Fig. 65). The larvæ of this form develop in a louse found on the skin of dogs and cats. Children who play with infected animals are the ones affected, the parasite being conveyed to the mouth usually by means of the hands; it may thus be found even in young infants. Most of the tapeworms in infants are of this variety. This form of tænia is much smaller than either of the preceding varieties, the full length being only from six to twelve inches.

Bothriocephalus Latus (Fig. 66). This is a rare form except in the sea countries of northern Europe and Switzerland, where it is said to be very common. The larvæ are harboured by certain fish, through which they are introduced into the body. The full-grown worm is from twenty-five to thirty feet in length.

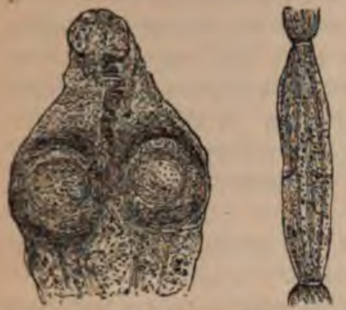

FIG. 65.—Head and segment of tænia cucumerina. (Jaksch.)

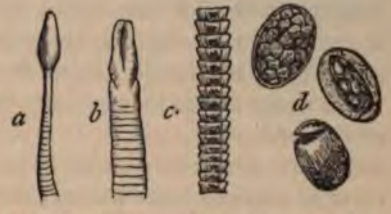

FIG. 66.—Bothriocephalus latus; *a*, *b*, front and side views of head; *c*, segments; *d*, eggs. (Jaksch.)

Tænia Nana and Tænia Flava Punctata. These are two rare varieties that have been found in children in a few instances.

Usually but a single worm is present, although as many as five or six have been found. Rarely tæniæ have been associated with round and also with threadworms.

Symptoms.—The only positive evidence of tapeworm is the discharge of the separated segments, either singly or in groups. Occasionally worms pass into the stomach and are vomited. Various abdominal symptoms may be associated with worms, but most of these are very indefinite in character and are more often due to other causes. The most frequent symptoms are bad breath, various annoying sensations, colicky attacks, inordinate or capricious appetite, and diarrhœa. Usually, if the patient is in good health, no constitutional symptoms are seen. Sometimes, particularly with the bothriocephalus latus, there is a very grave degree of anæmia. Many cases are now on record, some of them in children, in which the symptoms of pernicious anæmia have been present and have disappeared after the expulsion of the tapeworm. Nervous symptoms are not so often seen as with roundworms, and will be discussed in connection with them.

Treatment.—Prophylaxis requires the cooking of meat to a sufficient degree to destroy the cysticerci. There is especial danger in eating raw pork or sausage; that from rare beef is much less. The list of drugs used for the expulsion of the worm is a long one; probably the most satisfactory is the oleoresin of male fern, which should be given in capsule, in ♏xv doses to a child of ten years, four capsules usually being administered at hourly intervals. The vermifuge should be preceded by several hours' fasting, and the bowels should be previously opened by a laxative.

The following plan of administration has been found satisfactory: A light supper of milk, and in the morning a saline laxative on rising, but no breakfast; after the saline has acted freely the capsules are to be given, and following the last one, half an ounce of castor oil or some other active purge. Only milk should be given that day. The fragments passed should be carefully examined to see if the head has been expelled, as the worm is very likely to be broken at the neck. If this occurs it will grow again, and in about three months segments will appear in the stools. Other drugs useful for tænia are infusion of pomegranate root, turpentine, and chloroform.

NEMATODES.—Two varieties are found in the intestinal canal, the *ascaris lumbricoides* and the *oxyuris vermicularis*.

Ascaris Lumbricoides—Roundworm.—This worm occupies the small intestine. It is much more frequently met with in children than the tapeworm. It is exceedingly rare in infancy, but is usually seen between the third and tenth year. In over one thousand autopsies upon infants I have only once found a roundworm in the intestine.

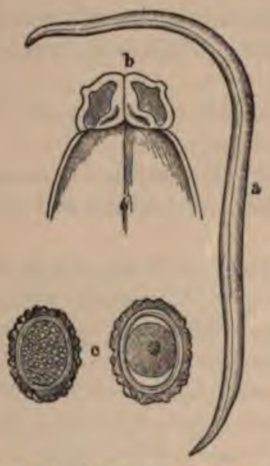

FIG. 67.—Ascaris lumbricoides; *a*, entire worm; *b*, head; *c*, eggs. (Jaksch.)

The roundworm is from five to ten inches long, the female being longer than the male. It is of a light gray colour with a slightly pinkish tint, cylindrical, and tapering toward the extremities (Fig. 67). The eggs are oval in form, about $\frac{1}{400}$ inch in diameter, and are numbered by millions. These worms rarely exist singly; usually from two to ten are present, but there may be hundreds, and even thousands. When very numerous they coil up and form large masses, which may cause intestinal obstruction.

The life history of the roundworm is not yet perfectly understood. Epstein cultivated outside of the body eggs taken from the stools, and found that under favourable conditions of sun and air five weeks were required for the development of the embryo. These were then fed to children. In three months the ova appeared in the stools, and after the administration of santonin many worms were discharged. From these experiments it would appear that no intermediate host is required, although this was previously supposed to be the case. It was believed that the ova were swallowed by some worm or insect, and in this form were taken into the intestinal canal with green vegetables, fruit, or drinking water.

The migration of these worms is curious, and in some instances truly remarkable. They frequently enter the stomach and are vomited. Occasionally one may appear in the nose. They have been known to pass through the Eustachian tube into the middle ear and to appear in the external meatus. Entering the larynx they have produced fatal asphyxia. It is not very rare for them to enter the common bile duct and produce jaundice. They may even enter in great numbers the smaller bile ducts and produce hepatic abscesses. They have been found in the pancreatic duct, in the vermiform appendix, and in the splenic vein. It has long been known that they would perforate an intestine which was the seat of ulceration, but well-authenticated cases have been reported in which they have perforated an intestine previously healthy, setting up a fatal peritonitis. In Archambault's case they perforated the stomach. In cases of a persistent Meckel's diverticulum, worms have been discharged from an umbilical fistula. They have been found in umbilical abscesses. Considering, however, the frequency of roundworms, migrations are rare.

Symptoms.—The symptoms of roundworms are of the most indefinite kind. Often there are none until the worm is discovered in the stools. It is then fair to assume that others are also present. The most frequent abdominal symptoms are colic, tympanites, and other symptoms of indigestion, loss of appetite, restless, disturbed sleep, grinding of the teeth at night, and picking the nose. These symptoms are much more frequently due to other causes than to worms, but when all are present the existence of worms should be suspected.

A great variety of nervous symptoms may be associated with intestinal worms. They are more often seen with lumbricoids than with either of the other varieties. The symptoms may be of the most puzzling character, and may simulate very closely those of serious organic disease. There may be chills, headache, vertigo, hallucinations, hysterical seizures, epileptiform attacks, convulsions, tetany, transient paralyses such as strabismus, and even hemiplegia and aphasia. All these have been observed in connection with intestinal worms, and from the fact that the symptoms disappeared completely after the worms were expelled there seems to be but little doubt that they were the cause of the symptoms. As in the case of the abdominal symptoms, however, intestinal worms are only one of the causes of such nervous disturbances, and certainly not the most frequent; but the possibility that they may depend upon worms should not be overlooked.

The only positive evidence of the existence of roundworms is the discharge of a worm from the body, or the discovery of the ova in the stools. A microscopic examination of the stools is a valuable means of diagnosis, and one that is too infrequently employed. When worms are present the ova may be found in great numbers. Their continued presence after the discharge of one worm, indicates that other worms remain.

Treatment.—Altogether the most efficient agent for the removal of the worms is santonin. The same plan of administration may be followed as in the case of the tapeworm—viz., to give the drug on an empty stomach, preceded by a laxative. Santonin is best given in powdered form mixed with sugar. For a child of five years three grains are usually required. This amount should be given in three doses at intervals of four hours, followed by a purge of calomel or castor oil.

Oxyuris Vermicularis—Pinworm—Threadworm. The oxyuris (Fig. 68) resembles a short piece of white thread. The female is about one third of an inch long, the male about one half that length, but is less frequently seen. The worm tapers toward the tail. The ova are of slightly irregular size, and are considerably smaller than those of the roundworm.

The oxyuris inhabits chiefly the rectum and lower colon; less frequently it may be found as high as the cæcum. These worms have been seen in the stomach, and even in the mouth. If present they are usually discovered by separating the folds of the anus. The number of worms is usually large. The irritation to which they give rise, causes a great production of mucus, and frequently leads to a chronic catarrh of the colon of considerable severity. The worms are imbedded in the mucus; often they form with it small balls. According to Leuckart, they are incapable of multiplying *in situ*. For development, the ova must be swallowed by the patient or some other individual. They as well as the worms are passed in enormous numbers with the stool. They attach themselves to the folds of the skin, the hairs about the anus, and even to the genitals. The patient may, through lack of cleanliness of the parts, continually re-infect himself. After discharge from the body, the ova may be carried by flies and deposited upon fruits, vegetables, or in drinking water.

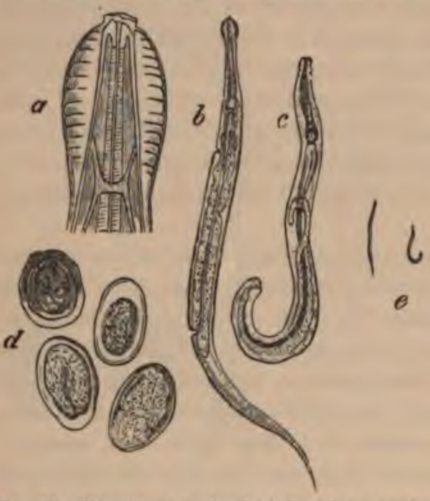

FIG. 68.—Pinworms. *a*, head; *b*, female; *c*, male; *e*, female and male, natural size; *d*, ova. (Jaksch.)

Symptoms.—The principal symptom caused by the oxyuris is itching of the anus or the genitals. This is caused by the migration of the worms from the bowel, and usually comes on at about the same hour at night, generally soon after the patient has retired. It is sometimes so intense as to be almost intolerable. It leads to frequent micturition, to incontinence of urine, in the male to balanitis, and in the female to vaginitis or vulvitis, and in both, but especially in the latter, it may be the cause of masturbation. Owing to the catarrhal colitis which is excited, there is discharged a large quantity of mucus. The irritation may lead to prolapsus ani. Nervous symptoms are not so frequently associated as with the other varieties of worms, although I have seen at least one case of chorea in which they were almost certainly the cause. They have been known to excite convulsions.

Treatment.—This is usually spoken of as a very simple matter, and no doubt in recent cases, or where the number of worms is small, this is true; but where the number is large, and considerable catarrhal inflammation of the colon is present, it is often a matter of the greatest difficulty to rid the bowel of these parasites. Cases often resist the most approved methods of treatment for months, even though carefully and thoroughly applied. The reason for this difficulty is, that the whole colon is doubtless infected, and that the upper part is very imperfectly reached by injections. While, therefore, injections are important and indeed invaluable, they can not be relied upon exclusively. The most scrupulous attention to cleanliness is an absolute necessity as the first step in the treatment of all cases. It is well to bathe the parts about the anus after each stool, and even two or three times a day, with a bichloride solution, 1 to 10,000. Itching is best controlled by the application of mercurial ointment to the folds of the anus at bedtime, this effectually preventing the escape of the worms from the bowel. The local application of cold will sometimes have the same effect. The most efficient of the injections is probably the bichloride. The colon should first be thoroughly cleansed by an injection of lukewarm water containing one teaspoonful of borax to the pint, in order to remove the mucus. When this has been discharged, half a pint of the bichloride solution mentioned should be injected high into the bowel through a catheter, and retained as long as possible. This should be repeated every second or third night. On other nights a simple saline injection may be employed. The infusion of quassia, asafœtida, aloes, and garlic are also useful.

When the worms are high in the colon, drugs by the mouth must be combined with injections. The worms must be dislodged by the use of saline cathartics, and simple bitters, especially quassia and gentian, should be given by the mouth. I have known one case, which resisted for over two years everything which had been tried, cured in two or three weeks by injections of a decoction of garlic, in connection with which garlic was given in large quantities by the mouth.

CHAPTER XI.

DISEASES OF THE RECTUM.

PROLAPSUS ANI.

UNDER this term are included two conditions. In the first, or partial prolapse, there is simply an eversion of the mucous membrane which protrudes beyond the sphincter. In the second, or complete prolapse, there is invagination of the rectal wall for a variable distance, usually two or three inches.

Etiology.—Prolapse is most common in children during the second and third years. Its frequency in early life is partly due to the lack of support furnished by the levator-ani muscles. It also occurs very readily when the ischio-rectal fat is scanty; it is therefore often seen in children suffering from marasmus. The exciting cause may be anything which provokes severe and prolonged straining. This may be either the tenesmus accompanying inflammation of the rectal mucous membrane or chronic constipation. It may come from phimosis or stricture of the urethra, and it is a very frequent symptom of stone in the bladder.

Symptoms.—Prolapse usually occurs during the act of defecation. It is generally easily reduced, but shows a great disposition to return with every stool. In obstinate cases the bowel comes down at other times. The appearance of the tumour varies with its size. In the slighter form there is simply a ring composed of a fold of mucous membrane surrounding the anus. In the more severe form there is a flattened, corrugated tumour, usually about the size of a small tomato (Fig. 69). The mucous membrane covering the tumour is of a deep purplish-red colour, and bleeds readily. It may be the seat of catarrhal or membranous inflammation. The diagnosis in most cases is easy, although the tumour has been confounded with polypus and intussusception.

Treatment.—In most cases reduction is easily accomplished by laying the child upon its face across the lap, and making gentle pressure upon the tumour with oiled fingers. The application of cold, either by means of ice or cold cloths, is of assistance in cases which are not at once reduced by pressure. After reduction, in the milder cases the child should be kept upon its back for at least an hour. Where the tumour tends to come down with every stool, special attention should be given at this time. If an infant, the bowels should always move while the child lies upon its back, and during defecation the buttocks should be pressed together by a nurse. Older children should use an inclined seat placed at an angle of about forty-five degrees, but should never sit upon a low chair or assume any position in which straining is easy. After defecation the patient should lie down for at least half an hour. Where there is constipation, the bowels should be kept free by means of laxatives. If there is a diarrhœa, tenesmus may be overcome by frequent sponging with ice water, or by the use of small injections of ice water and tannic acid, in the proportion of twenty grains to the ounce. In more severe cases it may be controlled by the use of suppositories of opium or cocaine. Where the bowel tends to come down frequently, this may be prevented by the use of an adhesive strap two or three inches wide, placed tightly across the buttocks. This is better in the milder cases than a T-bandage. The great majority of the cases are cured by these means in the course of a few weeks.

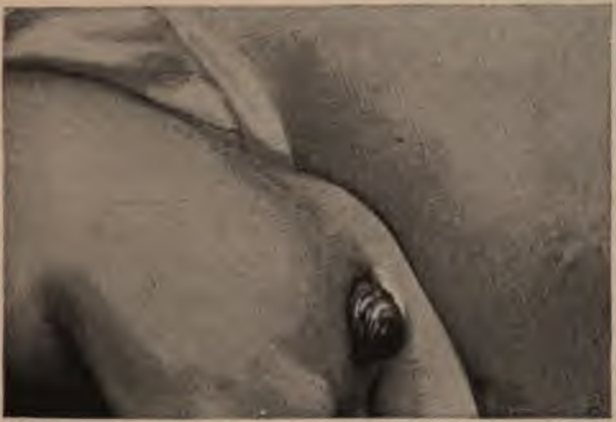

Fig. 69.—Prolapsus ani.

In the most severe cases the bowel not only protrudes during defecation, but also in the interval, and it may be down for weeks at a time. Such cases are rarely seen except in infants who have very flabby muscles, and but little adipose tissue at the floor of the pelvis. Reduction is sometimes difficult in cases where the prolapse has lasted a long time. It is often facilitated by painting the protruding part with a 4-per-cent solution of cocaine, and then dilating the sphincter by passing the finger into the central opening of the tumour. After reduction, suppositories containing from one fourth to one grain of cocaine may be inserted. They are more efficient than those containing opium or belladonna. A firm pad should be applied over the anus, held in position by a T-bandage. The tone of the levator and sphincter-ani muscles is often greatly improved by local injections of strychnia. For a child two years old $\frac{1}{100}$ grain may be used twice a day. Where these measures fail, the protruding part may be touched with the Paquelin cautery, linear markings being made at intervals of an inch. Amputation or excision is not required in children.

FISSURE OF THE ANUS.

This is not a very uncommon condition in children. The most frequent cause is the passage of a large, hard, fæcal mass. Sometimes it results from traumatism inflicted with the nozzle of a syringe while giving an enema. It may be produced by the scratching excited by pinworms. In the beginning there is a simple tear at the margin of the anus. The laceration which is produced usually heals promptly; but if the cause is repeated, healing is prevented, and there is finally produced a linear ulcer, or a true fissure, which may last for some time and be a source of great annoyance.

A fresh fissure has the appearance of any other tear at a muco-cutaneous orifice. One of longer standing has a gray base, slightly indurated edges, often discharges a small amount of pus, and bleeds a drop or two with nearly every movement of the bowels. The most constant symptom is pain, which usually occurs with the act of defecation, and continues for some time afterward. It is most severe when the fissure is just at the margin of the sphincter, and leads the child to resist every inclination to have the bowels move, so that it becomes a cause of chronic constipation, which condition again greatly aggravates the fissure. The pain is often referred to other parts in the neighbourhood.

The treatment is simple and usually efficient. It consists in cleanliness, overcoming the constipation, and touching the fissure with nitrate of silver, preferably with the solid stick. If the case is not speedily relieved by such measures, the sphincter should be stretched as in adult patients.

PROCTITIS.

Proctitis, or inflammation of the rectum, usually occurs with inflammation of the rest of the large intestine, but it may occur alone. It is to the cases in which only the rectum is involved that the term is generally applied.

The causes are for the most part local. A frequent one in infants is the use of irritating injections or suppositories, either for the relief of constipation or as a means of administering certain drugs. I have seen one obstinate case in an infant a year old, following the prolonged use of glycerin suppositories. It is sometimes caused by traumatism, especially by the careless giving of an enema. It accompanies pinworms. In certain cases it may result from direct infection through the anus. This may be from a gonorrhœal inflammation extending from the vagina or urethra, or from an infection due to other bacteria, particularly in cases of measles, scarlet fever, and diphtheria; or finally, it may be due to syphilis. The varieties of inflammation are the same as in the rest of the intestine. Proctitis may thus be catarrhal, membranous, or ulcerative.

Catarrhal Proctitis.—The pathological conditions are the same as in ordinary catarrhal inflammation of the intestinal mucous membrane. By the introduction of a speculum, or by simply everting the mucous membrane, it is seen to be reddened, swollen, and bleeds easily. There is a copious secretion of mucus. In cases of long standing there may be superficial ulceration appearing as a white or yellowish-white surface, usually just inside the sphincter.

The symptoms are chiefly local, although a condition of general irritability may result from the local condition. There is heightened reflex action, so that the stool often comes with a squirt. There is pain with defecation, and mucus is discharged, usually as a clear, jelly-like mass, and sometimes in the form of a cast, but not generally mixed with the stool. There are usually traces of blood, but rarely large hæmorrhages. In the most acute cases, tenesmus is always present both during and after the stool. There may be prolapsus ani. The skin in the vicinity is irritated by the discharges, most frequently so in infants. If the cause is pinworms, there may be intense itching. The duration of the disease is indefinite, depending upon the cause. It may be a few days or many months. The inflammation may extend from the rectum to neighbouring parts, leading to ischio-rectal abscess.

Membranous Proctitis.—It has been customary to describe this as a complication of diphtheria, usually occurring with diphtheria of the external genitals. As very few of these cases have been studied bacteriologically, it is impossible to say what proportion of them, if any, are to be regarded as true diphtheria. It is probable that the great majority are due to infection by streptococci. When the infection is from the intestine above, the rectum is never affected alone. When it is from below, this may be the case. The lesions are the same as in membranous inflammation occurring higher in the colon. The symptoms resemble those of the catarrhal variety, with the addition that the stools contain pieces of pseudo-membrane. This can be made out only by repeatedly washing the discharges with water. If accompanied by prolapse, the pseudomembrane may be seen. Membranous proctitis may be complicated by a membranous inflammation of the genitals or the perinæum. Although it is usually acute, it may last for weeks.

Ulcerative Proctitis.—Ulcers of the rectum may be the result of a catarrhal inflammation; these, however, are usually superficial, affecting the mucous membrane only, and in most cases heal rapidly. Sometimes they extend more deeply into the submucous or even the muscular coat. They are then chronic, often very obstinate, and may last indefinitely. Follicular ulcers of the rectum are nearly always associated with the same condition in the sigmoid flexure. These are always multiple and usually small, rarely being more than a quarter of an inch in diameter. Sometimes the small ones coalesce, producing much larger ulcers. Membranous proctitis is rarely followed by ulceration, although this is a possible result where sloughing has occurred. Single ulcers may be of tuberculous origin. Steffen reports two cases of tuberculous ulcer of the rectum in children of seven months and three years respectively. I have seen one in a young infant, which was fully three fourths of an inch in diameter, and was not associated with other tuberculous disease of the large intestine. Syphilitic ulcers are extremely rare in children.

The symptoms of ulcer of the rectum are mainly two—pain and hæmorrhage. The pain is of variable intensity, and may be referred to the coccyx, or to any of the neighbouring parts. The amount of bleeding may be small, the blood coming in clots, or it may be fluid and in so large a quantity as to produce general symptoms. It usually accompanies every stool. In addition the stool contains more or less pus, particularly in chronic cases. When the ulcer is low down, tenesmus is present and may be a prominent symptom. A positive diagnosis of ulcer can be made only by examination with a speculum.

Treatment.—In cases of acute catarrhal proctitis injections of some bland fluid should be employed, such as a starch-water, limewater, a mixture of oil and limewater, or a warm one-per-cent saline solution. The local cause, if one is present, should be removed. Where the stools are excessively acid, alkalies may be given by the mouth. The disordered digestion, when present, is to be treated according to its special symptoms. In the most acute cases the patient should be kept in bed. Where the tenesmus is severe, suppositories of opium or cocaine may be used. In the more chronic cases saline injections should be given, and followed by a mild astringent like tannic acid, ten grains to the ounce, or a one-per-cent solution of hamamelis. Cases associated with pinworms are especially obstinate. Here the treatment is first to be directed to the worms, and afterward to the proctitis.

In the membranous cases the same measures are to be employed, and in addition the injection of a warm boric-acid solution two or three times a day.

Cases of ulcer require the most careful treatment. In many there is but little tendency to spontaneous recovery. An examination with the speculum should be insisted upon in all cases of chronic proctitis, to make sure of the diagnosis. Rest in bed is essential to a rapid improvement. The patient should be put upon a bland diet, especially of milk, and the bowels kept freely open by the use of laxatives, and injections twice a day of a saturated boric-acid solution. Locally there should be applied a solution of nitrate of silver, one grain to the ounce, the bowel having previously been washed with tepid water. If a stronger solution than this is used, it should be neutralized after half a minute by the injection of a salt solution.

ISCHIO-RECTAL ABSCESS.

This is not a very rare condition even in infancy. Infection from the rectum, usually through the lymph channels, seems to be the most common cause, although sometimes the abscess may be traced directly to traumatism. In a single year I have seen six cases. All but two were small, circumscribed abscesses and quite superficial, apparently starting as an acute inflammation of the lymph glands of the region. They are analogous to a similar process in the lymph glands of the neck, seen in infancy. These cases healed promptly after incision. In other instances there is seen a disposition to burrow, as in adults. Only once have I met with diffuse suppuration in the ischio-rectal region, terminating in sloughing and death, and this was in an infant only three months old.

Essentially the same varieties of inflammation are seen in early life as in adults. Most of these cases recover promptly after simple incision and cleanliness, fistula being a rare sequel.

HÆMORRHOIDS.

These, fortunately, are not often seen in children, although they may occur even in those as young as three or four years. The principal cause is chronic constipation. The tumours are generally small and external, the chief symptom complained of being pain on defecation. Bleeding sometimes accompanies the pain, but the hæmorrhages are usually small. The treatment is to be directed toward the underlying cause. In most of the cases this suffices to cure the condition. I have never yet seen in a young child a case requiring operation, although neglect may make this procedure necessary.

INCONTINENCE OF FÆCES.

Inability to control the fæcal evacuations is seen in certain cases of paraplegia due to myelitis, in injury of the lumbar portion of the spinal cord, and in spina bifida. It is also seen in the coma of meningitis, and occasionally in the typhoid condition and in extreme adynamia, no matter in the course of what diseases they develop. In all these conditions incontinence of fæces is a symptom giving rise to much annoyance and needing careful attention. Uncleanliness with reference to excreta, seen in idiocy, can hardly be classed as incontinence.

Besides these familiar forms, the condition is sometimes seen from causes somewhat resembling those of incontinence of urine. The tone of the sphincter becomes so feeble that it does not resist even the slightest impulse to evacuate the rectum. The discharge may take place with but little warning, and may occur either by day or night. In some cases a local cause exists, such as stretching of the sphincter by a rectal prolapse or by impaction of fæces; more frequently, however, the causes relate to the general nervous condition of the patient. Fowler* (New York) has reported two very typical cases of this variety, and I have seen one. They are, however, very rarely met with in practice. Of the cases reported in literature, the majority have occurred in highly nervous, anæmic children. Fowler's cases were cured by the use of ergot given by the mouth and by suppository. In cases not relieved by this treatment, strychnia should be injected locally as described under Prolapsus Ani. In all cases the general condition should receive careful attention.

CHAPTER XII.

DISEASES OF THE LIVER.

THE liver is not often the seat of disease in infancy and early childhood. Nearly all the forms seen in adult life are occasionally met with in later childhood, although even then they are quite rare.

Size and Position.—The weight of the liver in the newly-born child, from one hundred and seven observations of Birch-Hirschfeld, is 4·5 ounces (127 grammes), or about 4·2 per cent of the body weight. The following table gives the results of one hundred and seventy-four observations upon the liver in infancy in the autopsy room of the New York Infant Asylum:

Weight of the Liver in Infancy.

AGE.	AVERAGE.		Per cent of body weight.
	Ounces.	Grammes.	
3 months	6·3	180	3·1
6 "	7·5	212	3·0
12 "	11·0	311	3·40
2 years	14·0	397	3·37
3 "	16·0	453	3·26

In adults, according to Frerichs, the weight of the liver is about 2·5 per cent of the weight of the body.

The upper border of the liver is best made out by percussion. In the child, the upper limit of the liver dulness in the mammary line is found in the fifth intercostal space; in the axillary line, in the seventh space; posteriorly, in the ninth space. The lower border is best determined by palpation. This, as a rule, in the mammary line is found about one half an inch below the free border of the ribs. According to Steffen, the left lobe is relatively larger in the child than in the adult. The liver may be displaced downward by contraction of the chest, as in rickets, or by an accumulation of fluid in the pleural cavity. It is frequently found lower than normal in conditions of great emaciation, owing to relaxation of the abdominal walls and its ligamentous supports. Upward displacement is much less frequent, and depends usually upon ascites or abdominal tumours.

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* American Journal of Obstetrics and Diseases of Children, October, 1882.

Malformations and Malpositions.—Congenital malformations relate chiefly to the bile ducts. These have been considered in the chapter devoted to Icterus in the Newly Born (page 76).

The liver may be found upon the left side in cases of general transposition of the viscera. In fissure of the diaphragm it has been found in the thoracic cavity.

ICTERUS.

Icterus, or jaundice, occurs in children, as in adults, from two general classes of causes. The first includes those cases in which there is some obstruction of the flow of bile from the liver into the intestine, or obstructive jaundice. In the second group, in which the jaundice is classed as non-obstructive, it depends upon certain changes in the blood itself. This is seen in the physiological jaundice of the newly born, in that associated with septic conditions and as the result of certain poisons.

Obstructive jaundice from pressure upon the bile ducts is extremely rare in children. Obstruction by a roundworm entering the common duct has been recorded, but is also very rare. The principal form of obstructive jaundice seen in early life, is catarrhal. This has already been considered in connection with Gastro-duodenitis (page 297).

FUNCTIONAL DISORDERS.

Functional derangements of the liver are undoubtedly exceedingly common in childhood. They are as yet but little understood, and it is almost impossible to separate them from the other symptoms of intestinal indigestion with which they are associated. These are described in the chapter upon Chronic Intestinal Indigestion. Some of these symptoms depend upon a diminution in the quantity, or the impoverished quality of the biliary secretion. There are gray or white stools, flatulence, and other evidences of increased intestinal putrefaction. These in all probability depend upon imperfect absorption in consequence of the absence of bile, rather than upon the absence of some antiseptic property, as recent experiments seem to show that the bile is not an intestinal antiseptic. The other functional disturbances of the liver relate to its effect upon the proteid substances which undergo destructive metamorphosis in this organ. The nature of this change, and the symptoms which result from this disturbance are as yet but imperfectly understood. It is quite probable that many of the nervous functional disorders of children—for example, attacks of migraine or of cyclic vomiting—may depend upon such a cause.

ACUTE YELLOW ATROPHY.

This form of hepatic disease, although rare in adults, is still more rare in children. Greves* has reported a well-marked case in an infant of twenty months, and has collected seventeen other cases under ten years of age; the youngest was in an infant three months old. The causes are obscure. The symptoms and course of the disease are essentially the same as in adults.

CONGESTION OF THE LIVER.

This occurs from the same cause as in adults. Acute congestion is not often seen. It may result from a malarial fever and from certain poisons, particularly phosphorus. Chronic congestion is more common, and is usually secondary to general venous obstruction dependent upon congenital or acquired heart disease, atelectasis, or other pulmonary conditions, particularly chronic pleurisy, chronic interstitial pneumonia, and emphysema. Chronic congestion of the liver causes no characteristic symptoms except a moderate enlargement of the organ. The disturbance of its functions is not of such a nature as to be diagnostic. In acute congestion, there may be in addition to the swelling of the liver, some localized pain or tenderness. The treatment is that of the original disease upon which the congestion depends.

ABSCESS OF THE LIVER—SUPPURATIVE HEPATITIS.

In 1890 Musser † found but thirty-four recorded cases of abscess under thirteen years. Since that time a few additional cases have been reported. This suffices to show how rare the disease is in early life. In the above collection, there have not been included cases of suppurative hepatitis occurring in the newly born.

As in adults, abscess of the liver may result from traumatism, or it may be secondary to suppurative pylephlebitis, which depends upon a focus of infection in the umbilical vein, or in some part of the abdomen from which the branches of the portal vein arise. Pylephlebitis may follow appendicitis (Bernard's case), it may follow typhoid fever directly (Asch's case), or be due to suppuration of the mesenteric glands or peritonitis following typhoid. In seven of the cases collected by Musser the disease was due to migration of roundworms from the intestine into the hepatic ducts. Menger (Texas) has reported one case following dysentery, the only one, I think, on record in this country. In quite a number of cases no adequate cause can be found. A striking example of this was reported to the New York Pathological Society by Swift, in 1882, where an abscess occupying nearly the whole right lobe occurred in a child three years old.

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* Liverpool Medico-Chirurgical Journal, July, 1884.

† Keating's Cyclopædia, vol. iii, p. 466.

In the cases occurring in pyæmia and in those associated with pylephlebitis there are usually several abscesses; in traumatic cases generally but one. The abscesses of early life do not differ very much from those of adults. If untreated, the majority of cases prove fatal either from exhaustion or from rupture into the pleura or peritonæum. In Asch's case spontaneous cure took place by rupture into the intestine.

Symptoms.—Occasionally abscess in the liver is latent, but in most of the cases the symptoms are marked and sufficiently characteristic to make the diagnosis a matter of no great difficulty. The most constant general symptoms are chills, which may be single, but are usually repeated; fever, which is commonly of the hectic variety and followed by sweating; prostration, vomiting, diarrhœa, and cachexia. Jaundice is present in less than half the cases, and is rarely intense. The liver is almost invariably sufficiently enlarged to be easily made out by palpation or by percussion; the enlargement in most cases is chiefly downward. Tumours on the surface of the liver are often present; these may be recognised as abscesses by the presence of fluctuation. Pain is quite constant, and frequently intense, but not always in the region of the liver. It may be in the epigastrium, at the umbilicus, in the lower part of the abdomen, and occasionally in the right shoulder. Tenderness over the liver is usually present. A positive diagnosis of hepatic abscess is to be made only by aspiration and the withdrawal of a fluid having the characteristics known as "liver pus." Pulmonary symptoms usually exist with an abscess occupying the convexity of the right lobe. There may be cough and dyspnœa from pressure, or pleurisy from extension of the inflammation through the diaphragm, or from rupture into the pleural cavity. The usual duration of abscess of the liver after the beginning of the symptoms is from one to two months. The prognosis will depend upon the cause of the disease. The pyæmic cases are usually fatal. In Musser's collection, the proportion of recoveries was about thirty per cent. At the present time, with improved methods of treatment and earlier diagnosis, the outlook is somewhat better than this.

Treatment.—This is purely surgical. Without operation the chances of recovery are very slight. A small number of cases have been cured by aspiration, but in the vast majority only incision and drainage are to be depended upon, and, if the abscess is accessible, should be resorted to as soon as the diagnosis is established.

CIRRHOSIS.

This is exceedingly rare in early life, although quite a number of cases are now on record between the ages of seven and fourteen years. Sixty-five have been collected by Howard * and fifty-three by Laure and Honorat.† Nearly all the cases in these collections were between nine and fifteen years. Cirrhosis in infancy is usually of syphilitic origin. Two thirds of those in Howard's collection were males. The etiology in most of the cases is obscure; in over half of those reported no cause could be discovered. Fifteen per cent of Howard's cases were traced to alcoholism, eleven per cent to syphilis, and eleven per cent to tuberculosis. Laure and Honorat believe that the eruptive fevers sometimes play an important part as an etiological factor, and that at other times the cause is possibly malaria.

The anatomical features of cirrhosis in early life are essentially the same as in adults. The liver is sometimes enlarged, but usually it is smaller than normal. The connective tissue may be distributed around the lobules, along the bile ducts, in irregular patches, or in striations through the organ. Associated with this there are atrophy and fatty degeneration of the liver cells. In some of the cases reported there has been also a similar increase in the connective tissue of the spleen and kidneys.

Symptoms.—These are very much the same as in adult life. In the beginning there are the indefinite disturbances referable to the digestive organs, and the liver may be found to be slightly enlarged; later there are ascites, enlargement of the spleen, and dilatation of the abdominal veins. Ascites is a pretty constant symptom, and is generally marked. Slight icterus is often present, but a marked amount is rare. There may be hæmorrhages from the stomach, from the nose, or from other organs; in a few cases there is slight fever. The late symptoms are a small liver, marked ascites with the consequent embarrassment of respiration, cachexia, and sometimes general dropsy. Diarrhœa is a much more constant symptom than in adults. Death usually takes place from exhaustion. The course of cirrhosis in children is commonly more rapid than in adults, and the progress is steadily downward.

Treatment.—Medicinal treatment is of avail only in cases which are syphilitic. These should be put upon mercury and large doses of the iodides. The treatment in other respects is symptomatic and palliative. As largely as possible patients should be kept upon a milk diet. The ascites may require aspiration or puncture, as in adults.

AMYLOID DEGENERATION (WAXY, LARDACEOUS LIVER).

This condition results from prolonged suppuration in connection with chronic bone and joint disease, especially of the hip, knee, or spine. More rarely it is seen with chronic empyema, tuberculosis, or hereditary syphilis. Amyloid degeneration of the liver is associated with similar changes in the spleen and kidneys, and sometimes in the villi of the small intestine.

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* American Journal of the Medical Sciences, 1887, p. 350.

† Revue Mensuelle des Maladies de l'Enfance, 1887, p. 97, 159.

The liver is generally very much enlarged; in extreme cases a weight of six or seven pounds may be reached. It is of a glistening, waxy colour, very firm and hard. With a solution of iodine, a mahogany-brown reaction is obtained. The amyloid degeneration affects first the arterioles, and finally the hepatic cells.

Amyloid liver *per se* produces few symptoms. Ascites is rarely present except in cases in which the liver is very large, and jaundice does not occur. In addition to the symptoms of the original disease in the course of which the amyloid degeneration occurs, there is the peculiar waxy cachexia which is seen in no other condition, but resembles somewhat that belonging to malignant disease. The face has the appearance of alabaster, and the skin has a singular translucency. The liver may be so large as to form a tumour, sometimes nearly filling the abdominal cavity. Not infrequently it extends to the umbilicus, and even to the crest of the ilium. The surface is smooth and hard, and the edges usually sharp. There is no localized pain or tenderness. The spleen is invariably enlarged. As a result of the amyloid degeneration of the kidney, there may be dropsy and albuminuria. Dropsy may occur from pressure of the large liver upon the vena cava, apart from the condition of the kidney. So many complicating conditions are usually present that it is almost impossible to say which of the other symptoms are due to the changes in the liver.

Amyloid changes take place slowly, the whole course of the disease being marked by years, the patient dying from slow asthenia, from nephritis, or from some acute intercurrent disease. As a rule, cases go on steadily from bad to worse; but sometimes, after the disease has reached a certain point, the condition is stationary for a long time.

The prognosis is always bad, although in a few cases improvement, and even cure, are stated to have occurred after the excision of the diseased joints upon which the amyloid degeneration depended. This, however, is a result which is not often met with. In cases of amyloid degeneration dependent upon syphilis, the usual anti-syphilitic remedies should be given. In other cases, no treatment is of any avail except that directed toward the removal of the cause.

FATTY LIVER.

This consists in an accumulation of fat in the liver cells. It is generally a secondary condition in childhood, and causes no symptoms by which it can be positively recognised.

Fatty liver is found at autopsy chiefly in children dying of marasmus, general tuberculosis, and in the other varieties of wasting disease, especially those associated with the digestive tract. In such patients it is particularly common, but under other conditions it is quite rare. It is found in children of all ages, being frequent in infants.

The liver is moderately enlarged, smooth, with rounded edges, of a yellowish-red or a lemon-yellow colour, and can be indented with the finger. A warm knife becomes coated with oil after cutting. Microscopically there is seen an accumulation of fat in the liver cells, usually irregularly distributed.

Jaundice, ascites, and the other peculiar symptoms of hepatic disease, are absent. The liver is moderately increased in size and its functions are interfered with, but not in such a way as to be recognised by the symptoms.

The treatment is that of the original disease.

HYDATIDS.

Echinococcus disease of the liver, while rare among adults in this country, is almost unknown in children. I have been able to find but two recorded cases in America.

From twenty-two European cases collected by Pontou (Paris, 1867), it appears that unilocular cysts are especially frequent in young subjects. The disease may be latent for months or years. The earliest symptoms are localized pain, jaundice, and occasionally fever. Later there is enlargement of the liver, particularly of the right lobe. If the upper surface is affected, pulmonary symptoms, cough and dyspnœa, are usually present; if the under surface of the organ, there is pressure upon the portal vein, the vena cava, bile ducts, stomach, and intestines. This pressure may cause icterus, dilatation of the superficial abdominal veins, and sometimes ascites. The local signs are enlargement of the liver with a tumour, which is easily recognised in children because of the thin abdominal walls. The hydatid fremitus is usually obtained. By aspiration a clear fluid is withdrawn, showing under the microscope the presence of the hooklets, which establishes the diagnosis. Occasionally cure may take place by spontaneous rupture or suppuration of the cyst, but in most cases, when left to itself, the disease proves fatal. The treatment is surgical, and consists in aspiration or in incision, and the evacuation of the cyst.

BILIARY CALCULI.

Up to the age of puberty calculi are extremely rare. Walker* has reported a case in a child dying at three months, who had symptoms from the age of one month. Parrot has put on record one case in an infant twelve days old. Frerichs records one in a child of seven, and Simon one at six years. In the cases reported the symptoms have been like those of adults—colic and icterus, and finally the passage of the stone by the bowels.

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* British Medical Journal, 1882.

CHAPTER XIII.

DISEASES OF THE PERITONÆUM.

INFLAMMATION of the peritonæum is not very frequent in childhood, because at this time most of the causes which are operative in later life either do not exist at all or are very infrequent. An analysis of 187 collected cases of peritonitis—not including those associated with appendicitis—gave the following results, which are of some interest as showing the relative frequency of the different forms in early life:

	Acute.	Chronic.	Total.
Fibrinous	22	10	32
Serous	22	15	37
Purulent	46	16	62
Tuberculous	18	38	56
Total	108	79	187

We shall consider separately acute, chronic, and tuberculous peritonitis.

ACUTE PERITONITIS.

Acute peritonitis may occur at any period of infancy or childhood. It may even exist in intra-uterine life. In the newly born, peritonitis is quite frequent. After this time it is exceedingly rare during infancy, only four cases, including all varieties, being met with in 726 consecutive autopsies in the New York Infant Asylum. After the fifth year the disease is relatively much more common. Of the 187 cases above referred to, 25 per cent occurred in the newly born, 21 per cent between one and five years, and 54 per cent between the fifth and the sixteenth years.

Etiology.—In the newly born, peritonitis is seen as one of the most frequent lesions of acute pyogenic infection (page 81). It is usually due to direct infection through the umbilical vessels. In infancy and childhood, peritonitis occurs both as a primary and secondary inflammation. The primary form is rare. It may be due to traumatism, such as falls or blows, or to surgical operations upon the abdomen; it has occurred after an injection for the cure of a congenital hydrocele. In a very small number of cases the inflammation seems to have been excited by cold or exposure, and it may follow severe burns.

The secondary form is more common. The most frequent of all causes is appendicitis. These cases are, however, considered separately elsewhere. Extension of inflammation from the viscera to the peritonæum is very much less frequent in children than in adults. It was met with but once in my autopsies (about 130 in number) in acute intestinal diseases.

It is also rare in typhoid fever, being noted but twice among my collected cases. It is occasionally due to abscess of the liver, ulcer of the stomach, acute intestinal obstruction from internal strangulation, intussusception, volvulus, or congenital atresia. It may extend from inflammation of the pleura. This may be in the form of empyema which burrows through the diaphragm, or, without burrowing, the infection may take place through the lymph channels. It is not very infrequently due to infection through the female genital tract, especially in gonorrhœal vulvo-vaginitis in young girls. Extension of inflammation from the male genital organs is not common. In one case at the New York Infant Asylum, fatal peritonitis in an infant originated in a suppurative inflammation of the tunica vaginalis of unknown origin, the infection extending into the peritonæum through the inguinal canal. Any abscess in the neighbourhood may rupture into the peritonæum and excite peritonitis. The most frequent in children are those connected with Pott's disease, perinephritis, and cellulitis of the abdominal wall.

Of the acute infectious diseases, peritonitis is most frequently seen with pneumonia and scarlet fever. In four cases occurring in the New York Infant Asylum the disease was twice secondary to pneumonia, in both complicated by extensive pleurisy. It may be accompanied by pericarditis, and even by meningitis.

The bacteria most frequently associated with acute peritonitis in children are: the streptococcus, especially in the newly born; the micrococcus lanceolatus (pneumococcus), in cases complicating pneumonia or empyema; and the bacterium coli commune in those following intestinal perforation. These may be associated with other pyogenic bacteria, or less frequently the latter may occur alone.

Lesions.—In the fibrinous form we have changes similar to those occurring in inflammation of the pleura and the other serous membranes. The peritonæum is injected and lymph is thrown out in considerable quantity, usually accompanied by a small amount of serum. The process may be localized or general. It is more frequently general in the child than in the adult. The peritonæum lining the abdominal wall, as well as that covering the coils of intestine and the solid viscera, is covered by patches of yellowish-gray lymph, causing adhesions between the various viscera and often matting the intestines together. In recent cases these adhesions are soft, and easily broken down; in old cases they are quite firm, and they may result in the formation of connective-tissue bands which are the source of subsequent trouble.

In the serous form there is a moderate amount of lymph, generally less than in the plastic variety, and, in addition, an outpouring of serum in considerable quantity. This is usually clear, but may be turbid from flakes of lymph, or it may even be bloody. In most cases the amount is not very large, usually varying from half a pint to two pints. In cases going on to recovery the serum is absorbed, but there may result adhesions as in the preceding variety.

In the purulent form the products are serum, lymph, and pus. When peritonitis results from perforation it is, as a rule, purulent from the outset, and the pus is foul and stinking. The amount of pus is generally larger than in adult cases. When the disease proves fatal in a few days there is found an extensive exudation of plastic lymph, with the formation of small pockets containing pus among the coils of intestine. Occasionally there may be larger collections of pus in the peritoneal cavity. In cases which have lasted a longer time—generally those of localized inflammation—the process results in the formation of a peritoneal abscess. This consists in a collection of pus in some part of the peritoneal cavity, the situation depending upon the cause, but it is usually in one iliac fossa or in the pelvis. The abscess is shut off from the rest of the peritoneal cavity by a thick wall of fibrin. If left alone, such abscesses may open into the rectum, vagina, bladder, pelvis of the kidney, or externally, usually at the umbilicus. After the discharge of pus the cavity may contract and fill up by granulations, and the patient recover.

Inflammations of the other serous membranes, especially the pleura, are often associated with peritonitis.

Symptoms.—The symptoms of acute peritonitis in older children, as in adults, are usually well marked and sufficiently characteristic to enable one to recognise the disease easily; but not so in the case of infants. In them the symptoms are often obscure, and the disease may be found at autopsy when not suspected during life. The onset is nearly always abrupt, with fever and vomiting. As a rule, the temperature is high—from 103° to 105° F. Vomiting may be only at the onset, but it often continues throughout the disease. Older children complain of pain, which may be localized or general; and in younger ones this is indicated by restlessness, crying, and fretfulness. The abdomen very soon becomes swollen and tympanitic, this being one of the most constant features of the disease. The distention is generally uniform, but it may be irregular. It is very rare in acute cases that there is a sufficient amount of fluid present to give the sensation of fluctuation. There are tenderness on pressure, and usually marked rigidity of the abdominal walls. The position assumed by the patient is generally dorsal, with the thighs flexed. The bowels are in most cases constipated, but diarrhœa is by no means rare. The abdominal distention causes dyspnœa and thoracic breathing. There may be retention of urine or frequent micturition.

The general symptoms almost from the beginning, are those of a serious disease. The pulse is small, rapid, and compressible. The prostration is great, from the very outset. The face is pinched, the mouth is drawn, and the features indicate pain. In bad cases there may be hiccough, cold extremities, clammy perspiration, and collapse. The mind is usually clear.

In the most severe forms of general peritonitis the course is short and intense, and the disease goes on rapidly from bad to worse until death occurs. In infants this is often on the second or third day. The most severe forms of general peritonitis in older children run the same rapid course. In other cases the course is slower, lasting a week or ten days. If the patient lives longer than this the case is more hopeful, because the process is more apt to be localized. The development of peritoneal abscess is indicated by the continuance of the temperature, which may assume a hectic type, and be accompanied by chills and sweating. There are the local signs of an abdominal tumour.

Prognosis.—Acute general peritonitis, whatever its cause, is a very serious disease in childhood. Of eighty cases of all varieties under sixteen years of age, sixty-nine per cent died. In the newly born and in infancy the disease is almost invariably fatal. In older children the outlook is not quite so hopeless, and depends upon the exciting cause. It is better in localized than in general inflammation; also in the fibrinous than in the purulent form; but the most favourable cases are those with a sero-fibrinous exudation.

Treatment.—The treatment of acute peritonitis in infants and young children is very unsatisfactory, since it is almost invariably fatal. In older children it is to be conducted along the same general lines as in adults. For a local application, cold is usually to be preferred if it is well borne. It may be applied either by an ice-bag or by Leiter's coil. Many children, however, rebel against cold applications, and for them heat must be substituted. The most satisfactory way of applying heat is by spongiopiline, which is wrung out of very hot water and applied over the whole abdomen. It may be sprinkled with spirits of turpentine if counter-irritation is desired, or a light poultice may be used. Feeding and stimulation are especially difficult on account of vomiting. The diet should be milk whenever this can be retained, which preferably should be peptonized. Kumyss may be tried when milk is rejected. Brandy with ice may be used as a stimulant, or, if this is vomited, champagne. No effort should be made to overcome the constipation except at the very outset, when a saline cathartic may possibly be admissible, but never at a later period. The treatment by opium is the only one upon which any dependence can be placed as influencing the disease. This is preferably given hypodermically, on account of the vomiting. The dose must be regulated by the condition of the patient. Enough should be administered to control pain and peristalsis. The amount required must be determined by the conditions in each case. An initial hypodermic dose of morphine for a child of five years should be from $\frac{1}{16}$ to $\frac{1}{24}$ grain. This will ordinarily need to be repeated every two or three hours. There is great tolerance of opium in cases of peritonitis, but there is no advantage in pushing the drug further than is required to relieve the symptoms mentioned. There are comparatively few cases in children in which the question of operation arises during the acute stage, except in those depending upon appendicitis. The cases of acute perforative peritonitis are almost certain to die under any treatment. Surgical interference is always indicated in peritoneal abscesses which have passed the active stage. These should be opened and drained in accordance with general surgical principles. Aspiration is not to be depended upon, and should be used only as a means of diagnosis.

CHRONIC (NON-TUBERCULOUS) PERITONITIS.

Peritonitis may occur in fœtal life with the production of extensive adhesions, which may interfere with the development of the intestine and result in various malformations. These cases have been ascribed by Silbermann * to syphilis.

Chronic peritonitis may follow the acute form, in which there are left adhesions which slowly increase owing to the production of new connective tissue. Such cases are sometimes chronic from the beginning.

The peritoneal abscesses which follow the suppurative form may run a chronic course. Chronic localized peritonitis may occur in connection with disease of any of the organs covered by the peritonæum. This is most commonly with the spleen, liver, and kidney.

Chronic Peritonitis with Ascites.—In most cases this is chronic from the outset and independent of the above causes. By far the most frequent form of inflammation is that due to tuberculosis, and by some writers the opinion is still held that this form is always tuberculous. After the observations reported by Henoch, Vierordt, Fiedler, and others, there seems to be no longer any room for doubt regarding the existence of a chronic non-tuberculous form of peritonitis with ascites, although it must be considered a rare disease. In its pathological and clinical aspects it is to be compared to subacute or chronic pleurisy with effusion.

Etiology.—Nearly all the cases thus far reported have occurred in children over six years. The causes are for the most part obscure. The disease has been attributed to exposure, rheumatism, and injury. In a few instances it has followed measles. It may be associated with disease of the intestines or the solid viscera of the abdomen, especially with new growths of the kidney, liver, etc.

Lesions.—The post-mortem observations thus far have been few. In the reported cases there has been found a large amount of greenish serum in the general peritoneal cavity, with a very moderate amount of fibrin and adhesions, which are sometimes few and sometimes very numerous. Chronic pleurisy may be associated.

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* Jahrbuch für Kinderh., Bd. xviii, 420.

Symptoms.—The early symptoms are of a very indefinite character, such as a decline in the general health, or dyspeptic symptoms; but often nothing whatever is noticed until the swelling of the abdomen begins. The enlargement comes on rather gradually in the course of a few weeks. Pain is slight, or wanting altogether. There may be some abdominal tenderness, but this is rarely marked. The bowels are irregular; sometimes there is diarrhœa and sometimes constipation. The abdomen is usually distended with fluid, the umbilicus protruding, and the superficial veins prominent. The enlargement is generally regular and symmetrical, and the wave of fluctuation is readily obtained. The general symptoms are very few. In some cases there is a slight evening rise of temperature of one or two degrees. There may be general weakness, loss of appetite, and moderate anæmia.

The usual course of the disease is for the fluid to remain for a time and then undergo slow absorption, the case going on to complete recovery. Occasionally relapses are seen. The results are not always so favourable, for in some instances there is no tendency to absorption of the fluid, the general health is gradually undermined, and the patients die from exhaustion or from some intercurrent disease. The diagnosis rests upon the presence of ascites, developing gradually without any signs or symptoms of disease in the heart, liver, or other organs. The points which distinguish it from tuberculous peritonitis are considered under that disease. In the cases which recover, the fact that no other signs of tuberculosis subsequently develop is an important point in diagnosis. The prognosis is in most cases favourable, but must be guarded on account of the difficulty in making a positive diagnosis from the tuberculous form. Recovery is usually complete and permanent.

Treatment.—It is important that the patient should be kept at rest, preferably confined to bed. The best results are usually obtained by the adoption of a general tonic plan of treatment. If absorption of the fluid does not begin with such means, saline diuretics should be given and the amount of fluid allowed the patient limited. When there is no tendency to absorption after a thorough trial of the above measures, and especially when the patient's general health begins to suffer, the fluid should be removed by aspiration. If it continues to accumulate after repeated aspirations, laparotomy may be performed, for in some cases this has the same beneficial effect as in tuberculous peritonitis.

TUBERCULOUS PERITONITIS.

The peritonæum is quite frequently the seat of tuberculous inflammation in early life; but not so often in infants as in older children. Of 56 collected cases, 7 were under three years of age, 26 from three to eight years, and 23 from eight to sixteen years. In 119 autopsies upon tuberculous patients, most of them under three years old, of which I have records, the peritonæum was involved in 8·5 per cent. In 105 autopsies, for the most part upon older tuberculous children, Ashby found the peritonæum involved in 36 per cent. In 883 collected autopsies upon tuberculous children of all ages, Biedert * found the peritonæum involved in 18·3 per cent. These figures do not represent the number of cases of tuberculous peritonitis, as in many of them only a few miliary tubercles were present.

It is no doubt possible for peritonitis to occur as the primary lesion of tuberculosis, but in the great majority of cases it is secondary. It may, however, appear as the most important tuberculous lesion in the body. The peritonæum may be infected directly from the intestine, the mesenteric glands or the pleura, or from more distant parts, like the lungs, the bronchial glands, the cervical, or other external glands. In a small number of cases some local exciting cause is present, such as a fall or blow upon the abdomen. It may follow exposure, or occur as a sequel to one of the exanthemata.

Tuberculous peritonitis may be acute or chronic. It presents several varieties quite distinct from one another, both in their pathological and clinical features.

1. **Miliary Tuberculosis of the Peritonæum accompanying General Tuberculosis.**—The peritonæum may be involved as one of the lesions in acute or subacute general miliary tuberculosis. This is the most common form seen in infants. The lesions consist in a deposit of miliary tubercles, which are generally rather sparsely scattered over the peritonæum. The evidences of inflammation are very slight, or they may be absent altogether. These cases do not come under observation as cases of peritonitis, as there are no abdominal symptoms.

2. **Miliary Tuberculosis of the Peritonæum with Ascites.**—Although not the most common variety in children, these cases form an important group. The peritonæum is thickly sown with miliary tubercles, both discrete and in conglomerate masses. They are found in the omentum and the mesentery, upon the surface of the intestines and the solid viscera. The peritonæum shows in varying degrees the changes of acute or subacute inflammation. There is congestion, with the production of a moderate amount of fibrin and a large amount of serum. In the most acute cases the fluid is in the general peritoneal cavity. In those of longer duration it may be sacculated. The fluid is usually abundant, but not excessive. It is most commonly an olive-coloured serum, but it may be seropurulent, and even bloody. There are commonly other lesions of tuberculosis in the body, but they are less marked than those of the peritonæum.

These ascitic cases generally run an acute or subacute course, the usual duration being from four to eight weeks. Clinically they present the symptoms of a moderate grade of peritoneal inflammation with ascites. The onset is rather gradual, with indefinite general symptoms. There is usually some fever—100° to 101·5° F. There are general weakness, prostration, and loss of flesh, but not rapid emaciation. Vomiting is not prominent, and pain and tenderness are rarely very marked. There may be nothing distinctive until distention of the abdomen is seen. This at first is due to gas, but later to fluid, which may accumulate in sufficient quantity to fill the general peritoneal cavity. The bowels are constipated, or there may be diarrhœa.

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* Jahrbuch für Kinderh., xxi, 178; see also Osler, Johns Hopkins Hospital Reports, vol. ii.

The usual course, when untreated, is for the disease to go on to a fatal termination from exhaustion. Less frequently the fluid is absorbed, and the case becomes one of the fibrous type, with a tendency to relapses; rarely it is followed by the ulcerative form.

3. **The Fibrous Form.**—This, in its general characters, may be compared to the fibroid form of pulmonary tuberculosis. There is a tuberculous inflammation, the products of which have undergone transformation into fibrous tissue. This may in a certain sense be regarded as a method of cure. The essential feature of the lesion in these cases is the production of extensive organized adhesions between the intestinal coils, and between the intestines and the abdominal walls. The intestines may be compressed against the spine by bands. Ascites may be present, but it is frequently absent altogether. If there is fluid, it may be in the general peritoneal cavity, or it may be sacculated, and it may consist either of serum or of sero-pus. There is no tendency to caseation or breaking down.

Clinically these cases are distinguished by their slow, irregular course. They are the most chronic of all the forms. The disease may be chronic from the outset, or it may follow the variety previously mentioned. The onset is generally insidious; fever is slight, or entirely absent. There is rarely vomiting. The bowels may be constipated or loose. For a long time the general health may remain good. The only characteristic symptom is the enlargement of the abdomen. In the early part of the disease this is chiefly from the tympanites, but later it may depend wholly or in part upon an accumulation of fluid. Ascites usually develops very slowly, but may be abundant. The adhesions of the intestines may give rise to irregularities in the outline of the abdomen. Ascites may be present for a time and then disappear spontaneously, and the general health may so improve that the patient is considered quite well. There may even be a permanent cure. In other cases, after symptoms have been absent for some time, relapses occur, and more fluid is poured out. In addition to these symptoms, others are present depending upon the mechanical effects of pressure from the contracting adhesions. There may be more or less constriction of the intestine, pressure upon the vena cava, the renal or portal veins, the thoracic duct or its branches, or upon the stomach. These may give rise to dyspeptic symptoms, emaciation, œdema of the lower extremities, and albuminuria.

In some cases the disease is entirely latent, and it is discovered at autopsy when there have been either no abdominal symptoms during life, or only colicky pains of an indefinite character. The course of this form is slow and irregular; it generally lasts for from three to twelve months, although with intermissions and exacerbations it may extend over several years. The fatal result may be due to an acute exacerbation, to exhaustion, or to the development of tuberculosis elsewhere.

4. **The Ulcerative Form.**—This is an inflammation associated with large tuberculous deposits which go on to caseation and softening. It may be compared to ulcerative phthisis. In point of chronicity it is midway between the two preceding varieties. It is one of the most frequent forms seen in children, and, while it may be localized, it is usually general.

There is commonly a very abundant fibrinous exudate, matting the coils of intestine together and causing them to adhere to the solid viscera and to the abdominal walls. In this exudate there are seen tuberculous deposits consisting of small, yellow nodules and larger caseous masses, often broken down at the centre. These caseous deposits are also found in the mesentery and in the omentum, which may be very greatly thickened. Pockets are formed by the adhesions which sometimes contain clear serum, but more frequently pus or a brownish fluid. The tuberculous deposits are found upon the peritoneal surface of the intestine, and infiltrate the intestinal walls, often leading to perforation, and sometimes to fistulous communication between adherent intestinal coils. There may also be tuberculous infiltration of the abdominal walls, accompanied by cellulitis, resulting in abscesses, which open externally, usually in the neighbourhood of the umbilicus.

The ulcerative form may succeed either the miliary or fibrous form, or the inflammation may be of this type from the outset. Tuberculous lesions are always found in the other organs, especially in the lungs, where they are usually advanced.

Clinically the ulcerative cases are characterized by well-marked constitutional symptoms, which are due partly to the peritonitis and partly to the general tuberculosis. Fever is regularly present, the temperature usually ranging from 99° to 103° F. Sometimes it assumes a distinctly hectic type. There are progressive emaciation, anæmia, prostration, and sweating. Diarrhœa is frequent and the intestinal discharges may at times be bloody. The abdomen is large, but not so much distended as in some of the other forms; the superficial veins are often prominent. It is rare that ascites can be made out by palpation, although fluid can usually be found by puncture. Areas of dulness and tympanitic resonance are irregularly distributed over the abdomen. Nodular masses from one to two inches in diameter may be felt on palpation. The epigastric and umbilical regions may be occupied by a smooth, hard, and board-like tumour, which is the thickened omentum. There may be the signs of phlegmonous inflammation of the abdominal wall in the neighbourhood of the umbilicus, and even an abscess, which, after opening, may leave a fistulous communication with the peritonæum. There are signs of disease in the lungs, and the pulmonary symptoms may mask those of the abdomen. The course of the disease is steady and progressive, the usual duration being two or three months. Death results from the pulmonary disease, from tuberculous meningitis, from exhaustion, and occasionally it is due to accidents associated with perforation.

5. **Peritonitis associated with Tuberculosis of the Mesenteric Lymph Nodes.**—These nodes may be tuberculous in any of the preceding varieties. In certain cases this is the principal lesion, and it is accompanied by localized peritonitis, which results in the formation of a large, irregular, nodular mass lying close against the spine. It is usually associated with tubercular ulcers of the intestine. There may be no symptoms except those depending upon the pressure of the glandular masses upon the great vessels. This may lead to œdema or to thrombosis of the vena cava, and may give rise to an abdominal tumour. There may be diarrhœa due to the intestinal lesions.

Diagnosis of Tuberculous Peritonitis.—In children, chronic ascites with fever usually means tuberculous peritonitis. If the abdominal effusion is sacculated instead of diffuse, the probabilities of peritonitis are much increased. If there are added the physical signs and symptoms of disease of the lungs, the diagnosis is almost certain. Cirrhosis of the liver is much more chronic in its course, and is very rare previous to the ninth year, being almost unknown in infancy and early childhood. In it there is often a history of syphilis, and jaundice may be present. If ascites is absent, tuberculosis of the peritonæum may be suspected if there are irregular nodules or tumours in various parts of the abdomen, with tenderness, emaciation, moderate pain, and slight fever. Chronic abscess in the neighbourhood of the umbilicus is always suspicious. The ulcerative form is almost invariably accompanied by evidences of advanced disease in the lungs and other organs, and is easily recognised. The fibroid form may be suspected if, with tuberculosis of other organs, there are irregular colicky pains and abdominal tenderness. From the abdominal symptoms alone it can not be recognised unless there is ascites. In all doubtful cases an exploratory incision should be made.

Between tuberculous and non-tuberculous chronic peritonitis a diagnosis is at times impossible. If there is a good family history; if there are no signs of tuberculosis in the lungs or elsewhere; if abdominal tenderness is slight or absent; if there are no nodular tumours; if fever and marked emaciation are wanting; and if the amount of fluid is excessive, the probabilities are in favour of a simple inflammation. There are, however, some cases in which the diagnosis can be made only by an exploratory incision, and sometimes not even then without an examination of the fibrous nodules by the microscope or by inoculation. In doubtful cases the chances are always in favour of tuberculous inflammation on account of its greater frequency.

Prognosis.—This depends most of all upon the form of the disease. Cases of the ulcerative type are absolutely hopeless. In the ascitic and fibrous forms the prognosis is quite good, especially since the general adoption of laparotomy as a means of treatment. Life is prolonged in nearly all cases by the operation, and a considerable number are permanently cured. Exactly in what proportion a permanent cure results, it is at present impossible to say, for most of the reported cases were not under observation long enough to make it certain that relapses did not occur.

Treatment.—The general treatment of tuberculous peritonitis is the same as that of tuberculosis in other parts of the body. In the acute cases the local symptoms are to be relieved by the same means as in other forms of acute peritonitis. The only local treatment which can be considered in any way curative is surgical. Nothing is to be said in favour of aspiration except for purposes of diagnosis. The results of laparotomy are so satisfactory that the question of operation should be considered in every case. The most favourable cases for operation are those of the ascitic variety. Aldibert,* in his monograph, gives the indications and contra-indications for operation as follows: Laparotomy is indicated in all forms accompanied by ascites, although in acute cases it may be only palliative; in suppurative forms which are diffuse, or with a unilocular cyst; in all cases of intestinal obstruction in the course of tuberculous peritonitis; and in all cases of doubtful diagnosis. Operation is contra-indicated in the fibrous form not attended by pain, this usually tending to spontaneous recovery; in the dry ulcerative form, except at the outset; in the suppurative form with multilocular cysts. The existence of other foci of tuberculosis does not contra-indicate operation except when these are chiefly intestinal, or when there is general tuberculosis with extensive and rapidly progressing lesions.

Aldibert has collected statistics of fifty-two operations for tuberculous peritonitis in children, with seven deaths and forty-five recoveries. Nine patients were reported well one year after operation. It is possible that among these cases some of simple inflammation have been included; of eighteen cases, however, in which the diagnosis of tuberculosis was established by the microscope or inoculation experiments, all recovered, and six were well one year after operation. Why it is that the operation of opening the abdomen and draining or washing out the peritoneal cavity should have such an influence in arresting the disease, has not yet been satisfactorily explained. For the surgical aspect of the treatment the reader should consult works upon surgery.

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* De la Laparotomie dans la Péritonite Tuberculeuse chez l'Enfant, Paris, 1892.

ASCITES.

Ascites consists in an accumulation of fluid, usually clear serum, in the general peritoneal cavity. It is a symptom of the various forms of peritonitis, especially the chronic varieties described in the preceding pages. It may be due also to portal obstruction from cirrhosis of the liver, or pressure upon the portal vein by peritoneal adhesions or large lymphatic glands. It is occasionally seen in all forms of abdominal tumours. Ascites may occur in general dropsy from cardiac disease, chronic pleurisy, or interstitial pneumonia, and from any condition causing pressure upon the vena cava. It is also seen in the general dropsy of renal disease. A moderate amount of ascites is often met with in extreme anæmia or leucæmia.

Small accumulations of fluid in the peritoneal cavity are difficult of detection. Large amounts are generally easily made out. There is a uniform smooth distention of the abdomen and dilatation of the superficial veins, especially about the umbilicus. On palpation, the wave of fluctuation can be obtained by placing one hand against the abdomen upon one side and giving the opposite side a sharp tap. A similar wave may be felt when there is tympanitic distention. The two are, however, readily distinguished by having an assistant make pressure with the edge of the hand along the linea alba while the test is being made; this obstructs the wave transmitted through the abdominal wall, but does not affect that through the fluid. On percussion in the sitting posture, there are dulness below and resonance above. When the patient is recumbent, there are resonance in the median line and dulness or flatness in the lateral portion of the abdomen.

The prognosis and treatment of ascites will depend upon its cause.

Chylous Ascites.—This term is applied to certain cases in which the abdominal fluid contains fat. The colour may be milky-white or light brown, and the fluid, after standing, may have at its surface a thick, creamy layer. The amount of fat present has been as high as five per cent. This condition is rare in childhood. In 1884, Letulle * could find but seven cases on record. The exact pathology is as yet not well understood. In the cases which have thus far come to autopsy there has usually been found chronic peritonitis, sometimes simple, sometimes tuberculous. The lymph vessels in some of the cases have been empty, and often no obstruction of the lymph circulation could be discovered. The fat is believed by some to be derived from fatty degeneration of the products of chronic inflammation, but this seems hardly sufficient to explain the large amount of fat sometimes found. In some of the cases it has been due to a wound of the thoracic duct. The amount of fluid is frequently very large. The prognosis is usually bad, although Pounds has reported (British Medical Journal, 1892) a case in a girl of ten years, where recovery followed laparotomy. Tuberculous peritonitis was present.

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* Revue de Médecine, 1884, No. 9.

SUBPHRENIC ABSCESS.

In the group of cases of localized peritonitis or peritoneal abscess must be included subphrenic abscess. This is a rare condition in childhood, and consists in an accumulation of pus just beneath the diaphragm and above the liver. Its cause may be either in the thorax or in the abdomen. It may complicate acute pneumonia, usually of the right lower lobe, by a direct extension of infection through the lymph channels. Sometimes it has been associated with phthisical cavities. In the abdomen it may be associated with disease of the liver. The accumulation of pus is sometimes very great, so that the diaphragm is crowded high into the thorax.

The symptoms and physical signs closely resemble those of empyema, and most of the cases have been operated upon with the belief that the surgeon was dealing with empyema. Meltzer* has reported a case in a child of two years which followed pneumonia of the right base. At the operation only a few drops of pus were found in the pleural cavity; but there was discovered a pinhole opening in the diaphragm, from which the pus had escaped from a large subphrenic abscess. This was evacuated, and the patient recovered perfectly. Subphrenic abscesses may contain air; they are then likely to be mistaken for pneumothorax. These abscesses require incision and drainage like other forms of peritoneal abscess.

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* New York Medical Journal, June 24, 1893. In this article will be found references to the recent literature.

SECTION IV.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

NASAL CAVITIES.

ACUTE NASAL CATARRH—CORYZA.

ALTHOUGH the symptoms of this disease are nasal, the principal seat of the pathological process is the rhino-pharynx.

Etiology.—Certain children are predisposed to attacks of acute nasal catarrh. This predisposition, as it sometimes extends to entire families, may be inherited; but more frequently it is acquired, and usually by the following mode of life: It is seen in children who get very little fresh air, because they are kept indoors unless the weather is perfect; who live in houses always overheated; whose sleeping rooms are kept carefully closed at night for fear they may take cold; who are for the same reason so overloaded with clothing that they can not engage in any active play without being thrown into a profuse perspiration. This condition after a time results in a great sensitiveness of all the mucous membranes, but especially those of the nose and pharynx. A small adenoid growth is very often present. Infants under three months old, and those who are rachitic, are frequent sufferers from acute nasal catarrh. It may be seen as a complication of dentition. Attacks are often brought on by insufficient covering for the head, by wetting the feet, by cold and exposure, especially to the raw winds of spring, accompanied by the dampness which occurs with melting snow. In susceptible children the exciting cause is often a very trivial one. A draught of cold air for a few minutes may be sufficient to excite sneezing and a nasal discharge. Atmospheric conditions are probably not the only cause of acute nasal catarrh. Micro-organisms certainly play an important part, particularly in the purulent variety. Although pyogenic germs are always present in the nose, they do not excite an attack of acute catarrh without the vascular changes which are produced by other causes. Acute catarrh may be sporadic or epidemic; it is probably contagious, being communicated by children using the same handkerchief or occupying the same bed.

Acute nasal catarrh may be a symptom of measles, nasal diphtheria, or influenza, and it may accompany erysipelas of the face.

Symptoms.—The changes in the mucous membrane of the nose are not great, and are usually secondary to those of the rhino-pharynx, being in a large measure due to the discharge. There are redness and slight swelling. The nasal passages may be for the time quite occluded by the discharge, which is usually profuse, at first sero-mucous, and finally, if the attack is severe, muco-purulent. The symptoms may be very transient, sometimes passing away in a few hours, in which cases there is only a vaso-motor disturbance; or they may continue and develop into a true inflammation. The discharge excoriates the nostrils and the upper lip. At the onset there is usually sneezing, and in infants often a slight fever. In older children there is no rise of temperature except in the most severe cases. The obstruction to nasal respiration causes mouth-breathing, and the dryness and discomfort which result from it produce disturbed sleep, snuffling and difficulty in nursing, this being in severe cases almost impossible. The inflammation may extend to the lachrymal duct, involving the eyes in a mild conjunctivitis. There may be closure of the Eustachian tubes, causing deafness and otalgia. There may also be secondary otitis. The process often extends to the larynx and bronchi, with hoarseness and cough.

In infants, severe cases may be followed by inflammation of the lymph glands of the neck or of the retro-pharyngeal region; in either it may terminate in abscess. Less frequently these catarrhal colds are accompanied by disturbances of the digestive tract, and there is vomiting, or diarrhœa with large mucous stools.

Attacks of acute nasal catarrh are stated by some writers to cause death in young infants by interfering with respiration. I have never seen dangerous symptoms, and believe them to be exceedingly rare, if, indeed, they ever occur as a result of a simple coryza. In the mild form the attack lasts from two to three days; in the severe form from one to two weeks. Repeated attacks are frequently followed by the development of the chronic form of the disease.

Diagnosis.—It is important to distinguish between a simple acute catarrh and one due to measles, influenza, nasal diphtheria, or hereditary syphilis. Measles and influenza cause more fever and general constitutional disturbance than does simple catarrh. Nasal diphtheria is characterized by the appearance of membrane in the anterior nares and by patches upon the tonsils. These may be wanting, however, and there may be only a very profuse discharge tinged with blood. When persisting for two or three weeks this is always to be regarded with suspicion, even though the constitutional symptoms may be very slight. The only positive means of excluding diphtheria is by cultures. A persistent acute nasal catarrh in a young infant should always suggest syphilis, and the patient should be carefully watched for the development of other symptoms.

Treatment.—A child suffering from acute coryza should always be kept indoors in a room with an even temperature of about 70° F., the bowels freely opened, and the amount of food somewhat reduced. The only drug which seems to have much influence upon the secretion is belladonna. This may be given in the form of atropine, gr. $\frac{1}{800}$ every hour to a child of six months. For older children a good combination is that known as the "rhinitis" tablet (camphor gr. $\frac{1}{4}$, quinine gr. $\frac{1}{4}$, fluid extract of belladonna ♏ $\frac{1}{8}$); one half a tablet may be given every hour to a child of five years.

Locally, either plain sweet oil or albolene may be applied by means of a medicine dropper, a brush, or a spray (page 55), an alkaline spray (page 56) having been first used to clear away the secretion. If the nasal obstruction causes great interference with nursing, a two-per-cent solution of cocaine may be applied with a brush, or with a probe and cotton, or dropped into the nostril just before each nursing. This is not to be advised unless the symptoms are severe, as infants are quite susceptible to cocaine. In all cases the upper lip and nostrils should be protected by vaseline or some simple ointment. Under no circumstances should irritating or astringent injections be given. In older children inhalations of spirits of camphor or fumes of carbolic acid may be used with advantage.

Prophylaxis consists in solving the perplexing question, so often put to the physician, of how to prevent children from "taking cold." This is a matter of the utmost importance, and follows what has been previously said under the head of Etiology. No amount of cod-liver oil and iron will remove this tendency to catarrh so long as bad hygienic conditions continue. Sleeping rooms should be large and well ventilated, and a window should be kept open at night, except in very severe weather or during acute attacks. The temperature of the house during the day should be from 68° to 70° F., but never above this. Children should be accustomed to go out of doors unless the weather is especially bad. So firmly rooted in the minds of the laity is the idea that acute catarrhs come from cold, that the habit of coddling delicate children is always likely to be carried to an extreme.

With every delicate and "catarrhal" child one should begin in the summer by having him live in the open air as much as possible, sleeping in a room with free ventilation, with moderate covering, and continuing the same practice into the fall and early winter. If begun gradually in this way there is little difficulty in continuing throughout the winter.

The next point to be insisted on is cold sponging immediately upon rising in the morning, especially about the chest, throat, and spine (page 55). The use of chest protectors, cotton pads, and extremely thick clothing should be prohibited. Flannel underclothing should be worn upon the chest throughout the year, and upon the legs also in winter; the very lightest in summer, and only a medium weight in winter.

Frequently repeated attacks point to the presence of adenoid vegetations in the pharynx, and no measures are of much avail until these are removed.

CHRONIC NASAL CATARRH.

This term is rather loosely used to designate a chronic nasal discharge. Such a discharge is frequent both in infancy and childhood. It is a condition much neglected by the general practitioner. Patients are too often subjected to routine constitutional treatment by cod-liver oil and preparations of iodine, with the idea that such cases are "scrofulous," while local treatment is either neglected altogether, or consists only of the use of the nasal douche or syringing with a saline solution. Sometimes, when suggested by parents, local treatment is opposed by the physician in the case of young children, and a great amount of harm follows. Permanent damage to the organs of hearing, smell, speech, and respiration may result from neglecting or ignoring chronic nasal catarrh in childhood.

Chronic nasal catarrh is not to be regarded as a disease, but only as a symptom which may be due to any one of a variety of pathological conditions, each of which requires very different treatment—viz., adenoid growths of the pharynx, foreign bodies in the nose, polypi, deviation of the septum or any other congenital deformity of the nasal passages, the various forms of chronic rhinitis, and syphilis, which causes a form of rhinitis peculiar to itself.

Adenoid Growths of the Pharynx.—These are more fully discussed elsewhere (page 263). They are by far the most frequent cause of chronic nasal discharge in infants and young children, and should be the first cause suspected. Every general practitioner may easily familiarize himself with the method of digital exploration of the rhino-pharynx, by which means these growths can in most cases be easily recognised. The nasal discharge accompanying adenoid growths is due to a chronic rhino-pharyngitis. Treatment is without avail unless the growths are removed. After this is done the nasal discharge usually disappears quite promptly.

Foreign Bodies in the Nose.—This condition should be suspected whenever there is an abundant muco-purulent discharge limited to one nostril. Foreign bodies in the nose are quite frequent in young children. Peas, beans, beads, or shoe buttons are most frequently lodged there. The efforts at removal on the part of the child, or even of the mother, generally result in pushing the body farther into the nose. It first sets up a mechanical irritation, accompanied by pain, swelling, sneezing, and sometimes hæmorrhage. This is followed by a catarrhal inflammation, which in the course of a few days becomes purulent, and may last indefinitely. The discharge is generally quite abundant. The symptoms point to an obstruction of one nostril, and an examination with the probe readily detects the presence of the foreign body.

In recent cases the removal of the foreign body may sometimes be accomplished by compressing the empty nostril and having the child blow his nose strongly. Often the sneezing which the body excites is sufficient to remove it. Before any attempt is made to seize the body with forceps cocaine should be used, not only for the purpose of preventing pain, but in order to shrink the mucous membrane so as to allow better manipulation. In many cases chloroform is necessary. In most circumstances ordinary foreign bodies can with proper forceps be extracted without difficulty. No subsequent treatment is required, except to keep the nose clean for a few days, as the inflammation quickly subsides after the removal of the cause.

Nasal Polypi.—These are among the infrequent causes of chronic nasal discharge in childhood. They are especially rare before the seventh year, but both mucous and fibrous polypi are seen. The symptoms are those of a chronic nasal catarrh with partial or complete obstruction of one or both sides. Polypi increase in size with the occurrence of every acute coryza, and are always especially troublesome in damp weather. They may be accompanied by reflex symptoms, such as cough, sneezing, and even by attacks of asthma. There may be headache, and sometimes disturbances of smell, taste, and hearing. The symptoms are of much longer duration than in the case of obstruction from a foreign body, the discharge is not so abundant, and is not purulent. The diagnosis is made only by examining the nose with the mirror and nasal speculum.

Polypi may be removed with the forceps, but this is best accomplished by the use of the wire snare. When they have been present for a long time the accompanying chronic rhinitis may require subsequent treatment.

Deviation of the nasal septum, and other congenital deformities which cause narrowing of the nasal respiratory tract, are conditions which belong to the specialist.

CHRONIC RHINITIS.

Three forms of chronic rhinitis are recognised—simple, hypertrophic, and atrophic.

Simple Chronic Rhinitis.—Simple chronic rhinitis existing alone is of very doubtful occurrence in young children. In the cases so classed the symptoms are due to rhino-pharyngitis, which almost invariably depends upon an adenoid growth.

The growth may be a small one, so that the symptoms of obstruction are slight or absent. A frequent complication is chronic enlargement of the cervical lymph glands.

The only constant symptom is an excessive nasal discharge, which is usually mucous, but which may be muco-purulent. It is easily removed by blowing the nose, if the child is old enough to be taught to do this. Children too young to clear the nose in this way, suffer from almost constant discomfort. The amount of discharge depends upon the severity of the case. It frequently causes irritation of the upper lip, which may be the seat of eczema or impetigo, especially in infants. The lip may be swollen and prominent. The condition of the external parts is aggravated by the constant disposition to pick the nose, which may be overcome by the application of a short anterior splint to each elbow. This condition is often the cause of epistaxis. The duration is indefinite; it may last for months or even for years, the symptoms in summer being insignificant, but returning every cold season. It may terminate in recovery, or in children with flabby tissues and delicate constitution, it may be followed in later childhood by hypertrophic rhinitis.

Treatment.—Prophylaxis is very important. The main purpose should be to prevent attacks of acute nasal catarrh by the measures mentioned in the discussion of that disease. The general treatment should not be routine, but directed according to the indications of each case. There should be careful attention to diet and to the condition of the bowels. Iron and arsenic are needed when there is anæmia. A general tonic treatment is required in most cases. Cod-liver oil and the syrup of the iodide of iron are both useful, but are not specifics, and must be intelligently combined with other measures.

Local treatment consists first in cleanliness, and, secondly, in the use of astringents in the form of powder or solution. For cleansing, a solution which is both alkaline and antiseptic is desirable. This may be used in the form of a spray, after which the nose is cleared by blowing; or in infants, if the discharge is abundant, the only efficient method of getting rid of it is by nasal syringing. This is attended by some risk of forcing materials into the middle ear; but if carefully done, the danger seems to me to be less than that of allowing the discharge to remain. Syringing should always be done with the mouth open and the head inclined forward. All solutions are to be made with sterilized water and used warm. But little force should be employed, and it may be well to have a syringe the nozzle of which does not completely fill the nostril. Either Dobell's or Seiler's solution (page 56) may be employed, diluted with an equal amount of water. As a spray the following may be used:

℞	Listerine *	℥ ss.
	Sodii bicarb.,	
	Sodii biborat.	āā ʒ ss.
	Aquæ	℥ iv.

If this is to be used with a syringe, twice as much water should be added. Ordinarily, the nose must be cleansed thoroughly twice a day, more frequently in very severe cases. Once a day, after the nose has been cleansed, an astringent solution or powder should be applied. One of the best solutions is sulpho-carbolate of zinc (gr. v to water ℥j). This may be used as a spray, or, better, dropped into the nostril with a medicine dropper, the head being held far back. A good powder is a combination of salicylic acid gr. iij, tannic acid, gr. xxx, and stearate of zinc ℥j, which may be used with an insufflator once daily.

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* Listerine is a combination containing the essential oils of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis.

Hypertrophic Rhinitis.—This is a chronic inflammation of the nasal mucous membrane, accompanied by a marked hypertrophy of all its normal structures, particularly its blood-vessels. The parts chiefly affected are those covering the inferior turbinated bones. The mucous membrane and submucous tissue are so thickened and relaxed that they may greatly encroach upon the nasal respiratory space, and when these venous sinuses are filled with blood, may entirely occlude the passage. There is usually associated with this condition some degree of hypertrophy of the adenoid tissue at the pharyngeal vault.

In young children hypertrophic rhinitis is a very infrequent disease, if, indeed, it ever occurs. It is fairly common in moderate degree in older children, although its severe forms are rare. It usually follows repeated attacks of acute nasal catarrh in children who have the diathesis "lymphatism." A frequent local cause is a deflected nasal septum.

The *symptoms* are those of nasal catarrh with bilateral nasal stenosis. The discharge is usually abundant, thick, and tenacious, being increased by dust and dampness. All the symptoms of nasal obstruction are present in varying intensity—the "wooden" voice, mouth-breathing, disturbed sleep, etc. There may be reflex cough, catarrh of the larynx or bronchi, accompanied by muscular or vaso-motor spasm, giving rise to spasmodic croup or asthma. Rhinoscopic examination shows the large pendulous masses of mucous membrane, usually red and irregular, more or less completely blocking the nasal passage. It is only by this examination that the disease is differentiated from adenoids of the pharynx, with which, however, it is frequently associated. In infants and young children the adenoid growth is much the more frequent, and throughout childhood generally the more important factor in producing these symptoms.

The *treatment* of these cases falls largely to the specialist, although very much can be done by the general practitioner if he will learn to use intelligently a few remedial agents. Constitutional treatment is indicated as in simple rhinitis, but if employed alone it accomplishes little or nothing. The purpose of local treatment is the reduction of the hypertrophied tissue by cauterization under cocaine anæsthesia, by glacial-acetic or chromic acid, or by the galvano-cautery. Each has its advantages and its advocates. If the hypertrophied tissue forms pendulous tumours, it may be removed by the wire snare. Both nostrils should not be operated upon at the same time. In most cases cauterization must be repeated several times at intervals of a few weeks. In the meantime one of the cleansing solutions mentioned on page 56 may be employed.

The following formula of Lefferts is an excellent one for a spray to be used in this condition :

℞ Iodi	gr. iv
Potass. iodidi	gr. x
Zinci iodidi,	
Zinci sulpho-carbolat	āā gr. xx
Listerine	℥ j
Aquæ	℥ iv

To be used as a spray once daily.

Atrophic Rhinitis (*Fetid Catarrh*).—This is unknown in young children, and only occasionally seen in those over twelve years old. It is characterized by the formation of crusts in the nose, which decompose and produce the horribly fetid odour. By some writers the term *ozæna* is applied to this disease, but usually this term is limited to rhinitis associated with disease of the bones. Atrophic rhinitis has been regarded by some as the late stage of the hypertrophic form. This view, however, is strongly combatted by Bosworth, who considers it the result of a purulent form of acute rhinitis. The changes consist in an atrophy of the mucous membrane and the destruction of many of the secreting glands. The nasal fossæ are large and roomy. The voice is not affected, but the sense of smell may be much impaired. There are no symptoms of obstruction. The discharge is scanty, and tends to accumulate between the bones, forming large crusts, which are expelled with difficulty by blowing the nose.

In the severe cases the *treatment* is only palliative, yet this is of the utmost importance for the comfort of the patient and those about him. The object of treatment is to prevent as much as possible the formation of crusts by the frequent use of an oil spray, such as albolene, in order to coat the dry mucous membrane. For the removal of crusts they must first be macerated by a prolonged nasal douche as hot as can be borne. This should be thoroughly used morning and evening as a part of the patient's toilet. In employing the douche, a bag containing from one to two pints should be suspended a few inches above the patient's head. One of the alkaline and antiseptic fluids mentioned on page 56 may be added to the douche. The head should be slightly inclined forward and the mouth kept open during the douche. The mechanical removal of the crusts may be necessary if they are large, hard, and impacted. Benefit may be derived in some cases from the daily use of a stimulating spray containing ten grains of menthol to one ounce of albolene. One of the very best deodorizers for general use is listerine, which, diluted with two or three parts of water, may be employed as a spray several times a day, in addition to the other measures mentioned.

Syphilitic Rhinitis.—Rhinitis is seen both in early and late hereditary syphilis. Coryza, or snuffles, is one of its earliest and most constant symptoms. It usually begins between the third and sixth weeks of life, rarely after the third month. The pathological condition is a subacute catarrhal rhinitis, sometimes with the formation of superficial ulcers or mucous patches. The disease is attended by a profuse discharge of sero-mucus or muco-pus, occasionally tinged with blood. It may continue from a few weeks to two or three months. It usually requires only constitutional treatment, and protection of the nostrils and lips by the use of the ointment of the yellow oxide of mercury diluted with four parts of vaseline. This may be introduced with the finger or brush for some distance into the nostrils. When the discharge is very abundant, any one of the cleansing solutions previously mentioned may be used as a spray.

The rhinitis of late hereditary syphilis is a very different pathological condition. There are here gummatous deposits which break down, and form ulcers of the mucous membrane and deeper tissues. There is also periostitis, with extension of the disease to the cartilages and bones of the nasal fossæ, particularly of the septum. There may be perforation of the triangular cartilage, necrosis of the vomer or nasal bones, perforation of the hard or soft palate, and at times extensive ulceration of the alæ nasi and the face. This may be followed by cicatrization, causing stenosis of the nostril. These lesions in the nose are generally accompanied by deep ulceration of the pharynx and soft palate. They usually occur in children who have presented the early symptoms of hereditary syphilis, but are occasionally seen when no such history can be obtained. Such was the case in a patient recently under observation in the Babies' Hospital, who had perforation of the nasal septum and of the floor of the nasal fossæ, causing a free communication with the mouth. These are cases of true ozæna. The odour from the discharge is at times almost intolerable. When neglected, these cases go on from bad to worse, and may continue for years, producing unsightly deformities.

The *treatment* is, to bring the patient fully under the influence of mercury, first by means of the mercurial ointment or by small doses of calomel—i. e., one tenth grain four or five times a day. Later the biniodide or the bichloride should be substituted, and iodide of potassium given in doses of ten to twenty grains three times a day. Tonics are needed in most cases, as the general health is frequently undermined and the patients are usually anæmic.

Locally there may be used a spray of one of the cleansing solutions already mentioned, or black wash, or a solution of bichloride, 1 to 10,000. For purposes of deodorization, listerine is one of the best remedies. Although improvement may take place quite promptly, the results of treatment are often unsatisfactory, as the disease has usually progressed so far before treatment is begun that some deformity of the nose results, usually a sinking in of the bridge and flattening of the alæ, giving rise to the so-called "saddle-back" deformity.

MEMBRANOUS RHINITIS.

The results of bacteriological examinations have shown that these cases, whose etiology was formerly the subject of considerable controversy, are nearly always due to the Loeffler bacillus, and hence are to be regarded as true nasal diphtheria. It has been difficult, from clinical features alone, to establish this relationship, as the disease differs in several important particulars from diphtheria of the pharynx and rhino-pharynx—viz., its prolonged course, the absence of glandular enlargements, and the presence of very mild constitutional symptoms, which are sometimes altogether wanting. These peculiarities are due to the very slight absorption which takes place from the nose, which is in striking contrast with that from the rhino-pharynx. The importance of recognising such cases as true diphtheria can not be overestimated, as they have often been the means of spreading infection in schools and institutions before their true nature was determined. The possibility of membranous inflammation of the nose arising from other micro-organisms than the Loeffler bacillus is not to be denied, but such cases are extremely rare.

The most striking clinical feature of primary nasal diphtheria is a nasal discharge of serum or sero-mucus, frequently streaked with blood. It is sometimes very abundant, at other times slight. There are also the symptoms of moderate nasal obstruction. The false membrane can in most cases be seen in the anterior nares as a gray or whitish exudation. It may cover the whole inner surface of the nose. It often remains for two or three weeks, when it may loosen and come away *en masse*, sometimes forming an entire cast of the nose. After forcible removal it may reform. The disease in very many cases remains limited to the nose, but it may at any time extend to the rhino-pharynx or to the larynx. When such an extension takes place it is accompanied by an increase in the constitutional symptoms, glandular swellings, etc. A positive diagnosis can be made only by means of cultures.

In addition to the general treatment for diphtheria, the nose in these cases should be syringed frequently with a warm saturated solution of boric acid, or bichloride 1 to 10,000, with 5 per cent of glycerin. Such cases must be isolated, like ordinary cases of diphtheria.

EPISTAXIS.

The hæmorrhage may come from any part of the nasal fossa, but it is generally from the anterior nares, and most frequently from the vessels of the septum. Epistaxis is a rare symptom in the hæmorrhages of the newly born, and when present indicates syphilis. It is infrequent throughout infancy, but in childhood it is quite common, occurring in boys more frequently than in girls. In the latter it is especially common about the time of puberty. Children who are kept much indoors in overheated apartments, and who have susceptible mucous membranes and flabby tissues, are particularly prone to it. The exciting cause may be a local one, like a fall or blow; it may be due to picking the nose, or to any kind of mechanical irritation; it may be associated with nasal catarrh; and it is often caused by an erosion upon the septum. An attack of bleeding may be brought on by mental or physical excitement. It occurs as an occasional, often an early symptom, in typhoid or malarial fever, in measles, or during severe paroxysms of pertussis. It is seen in the hæmorrhagic form of all the eruptive fevers, in certain cases of diphtheria, most commonly late in the disease, in hæmophilia and scorbutus, in grave anæmia, leucæmia, and in diseases of the heart and blood-vessels.

Symptoms.—Epistaxis is frequently preceded by a sense of fulness or pain in the head, which is relieved by the bleeding. The blood is usually from one nostril, and comes slowly by drops. The amount lost is generally small, but it may be large enough, when repeated, to produce a serious grade of anæmia even in strong children, and it has been the cause of death. Epistaxis may be overlooked if the blood finds its way into the pharynx and is swallowed. In most of the cases the hæmorrhage ceases spontaneously in from ten to twenty minutes, recurring at longer or shorter intervals, according to the nature of the cause. Hæmorrhage from adenoid growths of the pharynx may closely resemble that from the nose, but otherwise there can rarely be any difficulty in recognising epistaxis. In doubtful cases an inspection of the pharynx reveals the presence of blood-clots.

Prognosis.—This depends upon the cause. In the great majority of the so-called idiopathic cases it is not serious. Occurring early in the course of the infectious diseases it does not ordinarily affect the prognosis unless it is very severe. When it occurs late, however, it is always a bad sign, and particularly so in diphtheria. It may be serious in any of the hæmorrhagic diseases or in diseases of the blood, where it is not infrequently a cause of death.

Treatment.—To remove the predisposition, a child should receive general tonic treatment, especially plenty of outdoor exercise, and every means should be taken, by the use of cold baths, friction, and proper food, to tone up the vascular system.

An efficient means of arresting the hæmorrhage is compression of the nose between the thumb and finger. This may be combined with the application of ice over the root of the nose, and sometimes small pieces of ice may be introduced into the nostrils. The application of cold to the back of the neck or its use in the mouth may be of service by exciting reflex contraction of the capillary vessels. All tight clothing or bands about the neck should be loosened, and the patient kept quiet in the sitting posture. After the hæmorrhage has ceased the child should not blow his nose for some time. The use of the compound tincture of benzoin or lemon juice, diluted, or a weak astringent solution, like alum or tannic acid, will sometimes arrest hæmorrhage which does not yield to cold or pressure. The insufflation of astringent powders often increases the hæmorrhage because of the sneezing excited. If bleeding continues in spite of all the above measures, the anterior nares should be plugged with styptic cotton, and if this does not control it, the posterior nares should be plugged. Usually very little effect is seen from drugs given internally, although in frequently recurring hæmorrhages where no local cause can be discovered ergot should be given a trial in full doses.

In severe cases of nasal hæmorrhage recurring at short intervals without any apparent cause, ulcer of the septum should be suspected, and, if present, should be touched with chromic acid.

CHAPTER II.

DISEASES OF THE LARYNX.

THE characteristic feature of laryngeal disease in infants and young children is the association of muscular spasm with all forms of the inflammation. Often it is the laryngeal spasm, rather than the inflammation, which gives rise to the principal symptoms. This spasm is only one expression of the great reflex irritability of young children.

CATARRHAL SPASM OF THE LARYNX.

Synonyms: Spasmodic laryngitis, spasmodic croup, catarrhal croup (sometimes improperly called laryngismus stridulus).

The term *catarrhal spasm*, first suggested, I think, by Goodhart, is fairly descriptive of this disease, which is characterized by a very mild degree of catarrhal inflammation associated with marked laryngeal spasm.

Etiology.—It is not often seen during the first six months, but is frequent from this time up to the third year. After five years it is rare. It occurs in children who are well nourished, as well as in those who are cachectic. Certain children have a predisposition to such attacks; those who have had one attack are likely to have others. Heredity seems to have some influence in producing this susceptibility. Catarrhal spasm of the larynx is frequently associated with enlarged tonsils and adenoids of the pharynx, sometimes with elongated uvula. The exciting cause may be exposure to cold, an attack of indigestion, or constipation.

Lesions.—The catarrhal inflammation of the larynx affects chiefly the parts above the cords; there is congestion and dryness, and later increased secretion of mucus. To this there is added a spasm of the muscles of the larynx, especially the adductors. There is no submucous infiltration, and no tendency to œdema glottidis.

Symptoms.—The attack may be preceded for several hours by slight hoarseness, or by a nasal discharge. During the day the child may have appeared perfectly well. Usually there is heard during the evening a hollow, barking cough, at first infrequent and not severe. About midnight this is apt to increase in severity, and there is now difficulty in breathing. As soon as this becomes marked the child wakes, and presents the characteristic symptoms of an attack. In the mildest cases the dyspnœa is not sufficient to waken the child. In severe cases there is marked dyspnœa, especially on inspiration, and a loud stridor as the air is drawn through the narrowed opening of the glottis. This may often be heard even in an adjoining room. There is seen on inspiration deep recession of the suprasternal fossa, the supraclavicular spaces, and the epigastrium; also depression of the intercostal spaces, and even of the walls of the chest. The terror of the child or any excitement increases the spasm and aggravates the dyspnœa. The distress is very great; the breathing usually slow and laboured; the voice hoarse, but rarely lost; the cough stridulous, hoarse, and metallic; the pulse rapid; the temperature normal or slightly elevated, rarely over 101° F. The child sits up and struggles for breath, its forehead covered with perspiration. There may be slight lividity of the finger-tips and of the lips, and sometimes considerable prostration. In the course of three or four hours the attack slowly wears away and the child falls asleep. During the following day, aside from slight hoarseness and occasional cough, the child is apparently well. Most of the cases are not so severe as this; there are the croupy cough, hoarseness, and general discomfort, but not marked dyspnœa. On the second night there is a repetition of the experience of the first, usually quite as severe unless affected by treatment; and on the third day a remission similar to that of the day previous. On the third night the attack, if it occurs at all, is generally a mild one. Slight hoarseness persists for several days, but otherwise the child is apparently well. Many children have such attacks every few weeks in the course of the cold season, the slightest exposure or an indiscretion in diet being sufficient to induce one.

Prognosis.—This is good, the disease never, I think, proving fatal, although nothing is more alarming, at least to parents, than to witness for the first time one of these severe attacks of catarrhal croup.

Diagnosis.—Catarrhal spasm may be confounded with laryngismus stridulus and with membranous croup. Laryngismus stridulus is a rare disease, and occurs only in infancy. In it we have not simply stridulous breathing, but periods of complete cessation of respiration. These may be repeated many times during the day, and may continue for weeks, being often complicated by carpo-pedal spasm, sometimes by general convulsions.

From membranous laryngitis, catarrhal spasm is distinguished by its sudden onset, the mildness of the symptoms of inflammation, the spasmodic character of the dyspnœa, and the daily remissions. The history of previous attacks will often aid in diagnosis. In case of doubt, a positive diagnosis can often be made by allowing the child to inhale a little chloroform. This at once relieves dyspnœa due to spasm, while it has scarcely any effect upon that due to membrane.

Treatment.—The purpose of treatment during the attack is to produce relaxation of the laryngeal spasm. This is accomplished by the use of emetics, steam, and hot fomentations over the larynx. A favourite emetic is a tablet triturate of antimony and ipecac, gr. $\frac{1}{100}$ each. To a child of two years, one tablet may be given every ten or fifteen minutes, until free vomiting occurs; or a teaspoonful of the syrup of ipecac and fifteen drops of the wine of antimony at the same interval. When children do not vomit after two or three doses the antimony should not be repeated, as it may produce serious depression.

Emetics have a double value if the attack is due to indigestion. If there is constipation, an enema should be given. Following the free vomiting there is generally some improvement in the symptoms, but there may be a recurrence of the spasm unless other means are employed. To prevent this, antipyrine is one of the most useful drugs. Three grains may be given in divided doses to a child two years old. This may be repeated in four or five hours if necessary. Quite as much relief as that obtained from the drugs mentioned is seen from the use of steam inhalations. For this purpose the child should be placed in a closed tent, and steam introduced from a croup kettle (page 58). This may be used in conjunction with other measures, and continued as long as necessary. Poultices or hot fomentations over the larynx are often useful. In one case in which severe spasm had recurred for eight successive nights in spite of everything that was tried, the child being in great distress from the dyspnœa, I performed intubation, which gave instant relief. Tracheotomy, however, would scarcely be advisable.

During the day following the first night attack, it is well to continue the antimony and ipecac in doses too small to produce vomiting—e. g., gr. $\frac{1}{100}$ each, every four hours. After 6 P. M. the doses should be doubled, and at bedtime two grains of antipyrine given. If so treated, the symptoms may not recur upon the second night, or there may be only the cough without the severe dyspnœa. The child should be confined to the house for two or three days after one of these attacks, the drugs being gradually reduced; but the antipyrine should be given at bedtime for three or four successive nights.

To prevent a repetition of the attacks and remove the tendency to them, it is most important that the child should have plenty of fresh air and cold bathing, especially cold sponging about the neck and chest.

Everything which experience has shown to bring on the attack should be carefully avoided. Local causes, such as adenoid growths, hypertrophied tonsils, elongated uvula, etc., should receive appropriate treatment. Generally it is not necessary to exclude fresh air from the sleeping room. Although an open window for a single night may sometimes excite the attack, a persistence in this direction tends rather to diminish the susceptibility. If the child's condition is poor, general tonic treatment is to be employed.

ACUTE CATARRHAL LARYNGITIS.

This is not nearly so frequent as the disease just described, although it is much more severe, and may even be fatal. It occurs especially in children from one to five years of age, usually in the cold season. Predisposition to attacks is induced by the same conditions as in the case of acute rhinitis. Catarrhal laryngitis may be primary, when it is usually excited by cold or exposure,* or it may be secondary to measles, influenza, scarlet fever, or other infectious diseases. It may also be of traumatic origin, from the inhalation of steam or irritating gases.

Lesions.—There is a moderately intense congestion of the laryngeal mucous membrane, sometimes general and sometimes localized. This may be seen with the laryngoscope, but is not always visible after death. With the congestion there are swelling and dryness, followed by increased secretion. In the milder cases the process is limited to the mucosa. In the more severe cases it involves the submucosa also, which is congested, œdematous, and may be infiltrated with cells. The changes are especially marked in the lymphoid tissue of the subglottic region. The swelling may be sufficient to produce a very marked degree of laryngeal stenosis. In many mild and in all the severe cases there is associated catarrhal inflammation of the trachea, and often of the larger bronchi. In young children there is very little tendency to œdema glottidis, so frequent a complication in adults.

Symptoms.—In the mild form, such as that which is usually seen in older children, there are hoarseness, or even loss of voice, and a laryngeal cough which is sometimes hard and teasing, always worse at night. There may be pain and soreness over the larynx. Constitutional symptoms are mild or absent, the patient not usually being sick enough to go to bed, and often rebelling even at being kept indoors. The duration of the disease is from four to ten days, with a strong tendency to relapses from slight causes.

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* The following case is a good illustration of a severe attack excited by cold: A rather delicate infant, eight months old, an inmate of the New York Infant Asylum, was taken out on a raw December day with very slight covering. In a few hours hoarseness and stridor were noticed, and the temperature was 101° F.; three hours later it was 103°, and in spite of the usual remedies which were employed the dyspnœa had reached such a degree as to require intubation. The tube was worn only three days and the case made a prompt recovery.

The severe form of catarrhal laryngitis is sometimes preceded by acute coryza, or there may be mild laryngeal symptoms for a few days before the development of the more severe ones. In other cases the disease develops rapidly and severe symptoms are present within a few hours from the onset.

When the case is fully developed the voice is metallic and hoarse, and occasionally but not usually lost. There is a hoarse, dry, barking cough, which is very distressing, and sometimes almost constant. The cough, like the voice, is stridulous, and more or less stridor is present on inspiration. There is a slight amount of constant dyspnœa, but this is scarcely noticeable unless the chest is bared. Severe dyspnœa occurs in paroxysms, usually at night. Then, we may get the signs of obstructive dyspnœa similar to those mentioned in severe attacks of catarrhal spasm. This dyspnœa is chiefly inspiratory, but in some cases it increases steadily from the beginning of the attack, and may be indistinguishable from that due to membrane. Constitutional symptoms are usually present and may be severe. The temperature ranges in most cases from 101° to 103° F., but may go to 104° or 105°. The pulse is rapid and full and respiration is accelerated. Older children sometimes complain of pain in the larynx and trachea, increased by coughing. The symptoms are severe for two or even three days, the fever continuing with moderate prostration and paroxysms of dyspnœa, sometimes even attacks of suffocation and cyanosis. Usually after two or three days there is a gradual subsidence of the dyspnœa and inflammatory symptoms, and the case goes on to recovery. At other times the inflammation extends downward to the large and then to the small bronchi, and finally results in broncho-pneumonia. The attack may prove fatal from laryngeal obstruction due to swelling and spasm.

Diagnosis.—This disease is chiefly to be distinguished from membranous laryngitis. The onset of the two diseases may be very similar, and for the first twelve hours we have no absolute means of distinguishing between them, except possibly by the use of the laryngoscope, which is often conclusive in older children but not usually so in infants. All cases, therefore, should be looked upon with a degree of apprehension. The temperature in the catarrhal is usually higher than in the membranous form. The dyspnœa is mainly paroxysmal, with daily remissions and nightly exacerbations, and is chiefly inspiratory, while that of membranous laryngitis is constant, steadily and often rapidly increasing, and is present both on inspiration and expiration. In catarrhal laryngitis the voice is not usually lost, but in the membranous form this is the rule. There can be little room for doubt when there are enlarged glands, membranous patches on the tonsils, nasal discharge, and albumin in the urine. Very often, however, all these evidences of diphtheria are wanting, the really difficult cases being those in which the process begins in the larynx. The prevalence of diphtheria and a known exposure count for something in favour of membranous laryngitis. If cultures from the pharynx show the presence of Loeffler bacilli, diphtheria of the larynx is highly probable; but no conclusion can be drawn when cultures give negative results. In catarrhal as well as in membranous laryngitis there may be extreme dyspnœa, cyanosis, pallor, prostration, and even death.

Prognosis.—This depends somewhat upon the cause of the disease and also upon the age of the patient. It is much worse when it is secondary to measles or scarlet fever. It is better in children over three years of age than in infants, also when the general condition of the child is good. The prognosis in severe catarrhal laryngitis should always be guarded, not only on its own account, but also because it is impossible to be certain that the case may not be one of membranous laryngitis.

Treatment.—In all cases children affected are to be kept in bed; and the temperature of the room should be between 70° and 72° F. The diet should be light and fluid, and the bowels should be freely opened by calomel or a saline. A hot mustard foot bath should be given at the outset; also, benefit may sometimes be derived from aconite, given in one-quarter-minim doses every fifteen minutes for the first five or six hours. Antipyrine (two grains every four hours to a child two years old) is useful if there is much spasmodic dyspnœa. For this symptom emetics are beneficial, given as in catarrhal spasm. The use of ipecac and squills in smaller doses than is required for emesis (five drops each of the syrups of ipecac and squills every two hours) may give relief, especially in the early stage, when the cough is dry, hard, and severe.

All the remedies mentioned are to be regarded as accessories to the essential treatment, which consists in the use of inhalations. The child should be placed in a tent (page 58) into which steam is introduced from a croup kettle or vapourizer. Simple steam may be used, or turpentine, limewater, or creosote may be added. In moderately severe cases inhalations should be used for fifteen minutes every two hours; in very severe ones they should be continued the greater part of the time. Poultices or hot fomentations may be applied over the larynx. Relief is sometimes obtained by using counter-irritation by a mustard paste, but blistering should never be allowed. In my experience the local use of cold is very unsatisfactory, on account of the difficulty of applying it properly, and the objection to it on the part of young children. Stimulants may be required late in the disease, the amount of prostration being the guide to their use.

In cases of extreme dyspnœa operative interference may be needed. It is required more often in infants and young children than in those who are older, and especially in the subglottic form of the disease. Opinions will of course differ as to when the dyspnœa has reached the danger point.

One should not wait for general cyanosis. If pallor, marked prostration, and steadily increasing dyspnœa are present the case should not be allowed to go on without interference. Intubation has, to my mind, every advantage over tracheotomy, and is always to be preferred in these cases. One should not hesitate to operate, even though he may be perfectly sure that the case is one of catarrhal inflammation only. The severity of the dyspnœa is the only guide, and more than once I have seen cases shown at autopsy to be catarrhal, which were regarded during life as undoubtedly membranous. If intubation is done, the tube can usually be dispensed with in two or three days. Convalescence is usually rapid, but there is danger of recurring attacks during the remainder of the cold season.

MEMBRANOUS LARYNGITIS.

Synonyms: Membranous croup, true croup, laryngeal diphtheria.

Bacteriology has settled many questions long debated with reference to this disease. For nearly half a century the identity of membranous croup and laryngeal diphtheria has been contended for by some observers, and denied by others equally good. The extensive bacteriological researches made since 1890, both in this country and in Europe, have yielded results sufficiently uniform to warrant the following statements:

1. Membranous inflammation beginning in the larynx is almost invariably true diphtheria—i. e., it is due to the Loeffler bacillus.

2. Membranous laryngitis following a primary membranous inflammation of the tonsils, pharynx, or nose, is, in the great majority of cases, due to the Loeffler bacillus.

3. Membranous laryngitis following membranous inflammation of the tonsils, nose, or pharynx, occurring as a complication of measles, scarlet fever, or influenza, is more frequently due to another kind of infection (usually the streptococcus) than to the Loeffler bacillus.

The etiology, lesions, pathological relations, and bacteriological diagnosis of membranous laryngitis are considered in the chapter devoted to Diphtheria. In the present chapter there will be considered only the clinical aspect of the cases, especially of those in which the disease begins in the larynx; for even if the cause is in most cases diphtheria, the clinical picture is laryngitis.

In cases of primary laryngeal diphtheria there are wanting most of the characteristic clinical features which distinguish diphtheria of the pharynx. There are two reasons for this: one is the relatively rapid course of the disease, often producing death from local causes before the constitutional symptoms resulting from the absorption of the toxine have developed; the second reason is, that absorption of the poison by the laryngeal mucous membrane is very slow and feeble as compared with that which takes place from the pharynx. Hence it follows that glandular enlargements, albuminuria, and asthenic symptoms are generally wanting; also, that in the cases which come to autopsy early, the parenchymatous degenerations in the heart, kidney, and other organs are seldom found, but instead only such lesions as are connected with the laryngeal disease. The feeble contagion is due to the fact that the course is much shorter, and that the discharge from the nose and mouth is slight, or absent altogether.

Symptoms.—In its onset, membranous inflammation of the larynx is indistinguishable from the catarrhal form. It is perhaps a trifle less abrupt, and apparently not quite so severe for the first twelve hours or even for a longer time. We have the same hoarse cough and voice, with a slight stridor, gradually increasing. The constitutional symptoms are usually not quite so marked, the temperature ranging from 99° to 101° F. The pulse is accelerated, but not weak or intermittent. It is the progress of the disease which indicates its character, usually during the first twenty-four hours. A child beginning in the morning with such symptoms as have been described, may by evening show a decided change for the worse, or the symptoms may increase with great rapidity during the night. At first the voice is hoarse; later it is entirely lost. Dyspnœa in the beginning is scarcely noticeable, but steadily increases hour by hour. At times of excitement it may be very great, but as the spasm subsides it diminishes. During the second twenty-four hours all the symptoms are usually well developed. The respiration is often somewhat accelerated, but it may be slower than normal. The face is pale and anxious. The alæ nasi dilate with each inspiration. The loud, "sawing," stridulous breathing is present. As the dyspnœa increases, all the accessory muscles of respiration are brought into action. There is now with every inspiration deep recession of the suprasternal fossa, the supraclavicular regions, and the epigastrium. The child tosses uneasily from side to side in its crib, at times struggling violently to get more air into the lungs. The pulse grows rapid and weaker. There is slight blueness of the finger nails and the lips; the face is usually pale; but later this too may be cyanotic. The skin is covered with clammy perspiration. On auscultating the chest, very rude respiratory sounds are heard, but no vesicular murmur. As the symptoms increase in severity the temperature usually rises gradually, in some very severe cases at the rate of a degree an hour, until shortly before death it reaches 104° or even 106° F. Late in the disease the intellect becomes dull, the violent struggles for air cease, and the child passes into a condition of semi-stupor which gradually deepens until death occurs, which may be preceded by convulsions.

Such is the usual course of the disease when unrelieved by treatment. Its progress is most rapid in infants, in whom death usually takes place in from thirty-six to forty-eight hours from the first symptoms. In older children the course is rather slower, and the attack may last from two days to a week, death occurring more frequently from bronchial croup or pneumonia. These are indicated by continued high temperature, rapid respiration, cyanosis, and increased prostration.

The course of the disease is not always so regular. Occasionally for a week or more the symptoms are precisely like those of catarrhal laryngitis of moderate severity—hoarseness, laryngeal cough, little or no fever, and slight or occasional dyspnœa. Then there may be the sudden development of very severe symptoms, and death in a few hours. Great improvement may follow the dislodgment of the membrane by vomiting or coughing, although in most cases it forms again.

Prognosis.—The issue of every case of membranous laryngitis is doubtful. The prognosis depends upon the age of the patient, the character of the epidemic, but most of all upon the treatment. The latest results with antitoxine show a mortality of less than 25 per cent.

Diagnosis.—The points by which membranous laryngitis is distinguished from the catarrhal form have been considered in connection with the latter disease. It may be further confounded with retro-pharyngeal abscess, a foreign body in the larynx, and even with broncho-pneumonia. Inspection, or, better, digital exploration of the pharynx, usually makes the recognition of retro-pharyngeal abscess an easy matter. The mistake generally made is that of trusting entirely to the patient's objective symptoms for a diagnosis. With a foreign body there is usually a history of a very sudden onset and violent paroxysmal dyspnœa, without fever. Broncho-pneumonia is easily distinguished by its higher temperature, its physical signs, and the difference in the character of the dyspnœa. A mistake is hardly possible except when there is also present some degree of catarrhal laryngitis. In any of these conditions, if time is taken to obtain a careful history and to make even a moderately thorough examination of the throat and lungs, no mistake need be made. Yet such cases have often been operated upon by physicians anxious to give immediate relief to what they had hastily diagnosticated as membranous laryngitis.

Treatment.—All cases of membranous laryngitis should be isolated like those of diphtheria of the pharynx. Every case of membranous laryngitis should receive an injection of antitoxine upon a clinical diagnosis without waiting for this to be confirmed by a bacteriological examination. Nowhere else are the beneficial effects from antitoxine so evident and so striking as in these cases. That the serum, when properly used in the great majority of cases, prevents the spreading of diphtheritic membrane from the larynx to the lower air passages is now well established. For dosage and other details regarding the use of antitoxine the reader is referred to the article on Diphtheria.

Emetics, inhalations of steam, and solvents for the membrane, although they all sometimes give relief, are now little used, and are never to be relied upon alone. In fact, leaving out antitoxine and surgical operation, the only therapeutic measure that can be said to be of much avail is calomel fumigation. This is in no sense a substitute for antitoxine, but may be employed where circumstances make the use of antitoxine impossible, and in the few cases of membranous laryngitis due to streptococci.

Calomel fumigations.—These were first advocated by Corbin, of Brooklyn, in 1881, although they did not come into general use until about 1891. The method consists in the vapourization of calomel in a confined space, the patient inhaling the fumes. For this purpose the child should be placed in a close tent (page 58), either sitting or lying down. A very simple arrangement for the purpose, and one that can be extemporized readily, is the following: A strip of tin, or any sheet metal two inches wide and ten or twelve inches long, is bent and placed across the top of a *pot-de-chambre*; upon this is placed the calomel, and beneath it, so that the flame will come close to the tin, an alcohol lamp. The lamp is then lighted and the apparatus placed beneath the tent. It should always be steadied by the hand of an attendant, otherwise there is danger of fire, as the lamp might be accidentally overturned by the child's struggles. In Fig. 70 is shown an apparatus which can be used with greater safety, as it is suspended by a wire. In a few moments the tent, which should be kept closed, is filled with the white fumes of the mercury. From ten to twenty minutes are required to vapourize the ordinary amount used, depending upon the size of the flame. It is well to have the child somewhat accustomed to the tent before the fumigation is begun; also to cover the body, except the face, so as to prevent any unnecessary exposure to the calomel fumes. The usual amount vapourized at once is ten or fifteen grains, and this is repeated every one, two, or three hours, according to the severity of the case. This amount is calculated for a tent which covers a child's crib. If a much larger one is used more calomel will of course be required. In extreme cases as much as twenty grains every hour have been used for days. After the calomel has all been vapourized the tent should be opened and the room thoroughly aired.

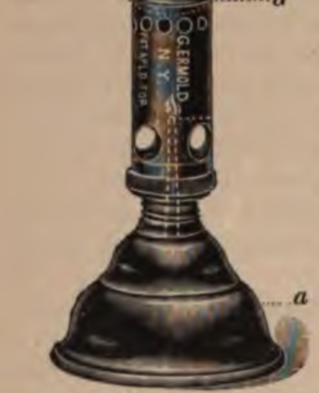

FIG. 70.—Ermold's apparatus for calomel fumigation.

a, alcohol lamp; *d*, plate on which calomel is placed; *e*, wire loop for suspension.

At times so much irritation is produced by the fumes that it may have the effect of increasing the dyspnœa. This may be due either to the fact that the calomel contains impurities, or that the vapour is too concentrated. The concentration of the vapour depends on the size of the tent and the rapidity of the process of vapourization. It is rare that any unpleasant symptoms occur. Nurses should always be warned against the danger of fire. I have several times known serious accidents from carelessness. Salivation in a patient is rare, but care is always necessary to prevent it on the part of the attendants. They should not put their heads beneath the tent; the room should be kept as clean as possible, and thoroughly aired after each fumigation. The mouth, gums, and teeth of the patient should be kept clean with a wash of chlorate of potash.

The improvement is often very marked even after the first fumigation, and nearly always after the second or third. Fumigations should be begun as soon as the diagnosis of membranous laryngitis is made, without waiting for even a moderate amount of dyspnœa. This applies both to cases beginning in the larynx and where the disease is secondary to pharyngeal diphtheria.

Operative measures.—Opinions will always differ as to the time when operative interference is called for. One should never wait for general cyanosis, for often this does not occur until just before death. It is better to operate too early than too late. After a fair trial has been made of other measures, and if, in spite of all, the dyspnœa increases steadily and the temperature begins to rise, operation should not be deferred longer. When this has been decided upon, the physician has the choice between intubation and tracheotomy. During the last ten years intubation has grown steadily in favour, and, since the introduction of antitoxine, tracheotomy has been practically abandoned as a primary operation for the relief of membranous laryngitis, it being resorted to only in rare cases, after intubation has failed to give relief.

The general treatment of the child is important, and should not be overlooked. It includes careful feeding, and the use of alcoholic stimulants according to the amount of prostration present. All patients with membranous laryngitis should be closely watched, for marked changes may take place in the course of a few hours.

Results without antitoxine.—In November, 1892, McNaughton and Maddren (Brooklyn), in response to a circular letter, collected statistics of 8,383 cases of membranous laryngitis, occurring in the practice of 242 physicians. The following results were reported: Tracheotomy, 2,417 cases; recoveries, 586, or 24·2 per cent. Intubation, 5,546 cases; recoveries, 1,691, or 30·5 per cent.

In 1893, Ranke (Munich) published reports of 1,445 cases of intubation, collected from various German hospitals, with 553 recoveries, or 38 per cent. Bokai (Buda-Pesth), in 500 operations, reports 180 recoveries, or 36 per cent. In all the different series of cases above referred to, the percentage of recoveries has ranged from 30 to 40. Combining them, we have 7,491 cases of intubation for membranous laryngitis, with 2,424 recoveries, an average of 32·3 per cent. These figures may be taken to represent, as accurately as statistics can, the results from intubation prior to the use of calomel fumigations and before the introduction of antitoxine.

With the introduction of calomel fumigations the statistics of the operation from 1891 to 1895 were materially improved. Of the cases of intubation collected by McNaughton and Maddren, only 85 had received calomel fumigations, with 35·3 per cent recoveries. Although no large collection of cases so treated has been made, the experience of Dillon Brown may be taken as fairly representing the improvement in the results of intubation by the addition of calomel. Up to June, 1894, he reports his personal experience as follows: 490 intubations without calomel fumigations with 34·8 per cent recoveries; 279 operations with calomel fumigations with 49·4 per cent recoveries. Nearly all of the cases in both series were from private practice. In addition to this reduction of mortality in cases operated upon, it was a matter of common observation in New York and Brooklyn, that during the period mentioned a much larger number of cases than ever before recovered without operation.

Such were the results in laryngeal diphtheria prior to the introduction of antitoxine in 1895. They have been fully given, that they may be compared with those obtained since that date with the addition of antitoxine. The latter figures are given in the general article on Diphtheria.

INTUBATION.

Intubation is the introduction of a tube through the mouth into the larynx for the relief of laryngeal dyspnœa. For the operation as now performed the world is indebted to Dr. Joseph O'Dwyer, of New York.

A set of O'Dwyer's instruments (Fig. 71) consists of six gold-plated tubes, an introductor, an extractor, a mouth-gag, and a gauge. In his latest tubes the lower extremity is made somewhat bulbous, and not straight, as appears in the illustration. The operation is not very difficult, provided one has had previous practice on the cadaver. Without this it should not be attempted. The tube is selected according to the age of the patient, the length for the different years being indicated upon the gauge. The age is not the only guide, for a very large child will often require a tube of larger size than its age would indicate.

The introduction of the tube.—Two assistants are required, neither of whom need be skilled. The child is taken from the bed, wrapped in a large blanket, and held in a sitting position upon the lap of the first assistant, its head being inclined neither backward nor forward. The arms may be confined by the blanket or held by the assistant. The second assistant, standing behind the child, steadies the head, and with one finger holds the loop of braided silk with which the tube should be threaded. The tube is attached to the introductor, and the gag is inserted into the left angle of the mouth and opened as widely as possible. The slipping of the gag and laceration of the mouth may be prevented by using a piece of rubber tubing to cover each arm of the gag where it comes in contact with the gum. The attempts at introduction must be made quickly, for during them respiration is practically arrested. Several short attempts are always better than a single prolonged one. Very little force is ordinarily required in introducing the tube, that used in passing a catheter being a good general guide. In cases of subglottic stenosis, however, quite a little force may be necessary (Brown).

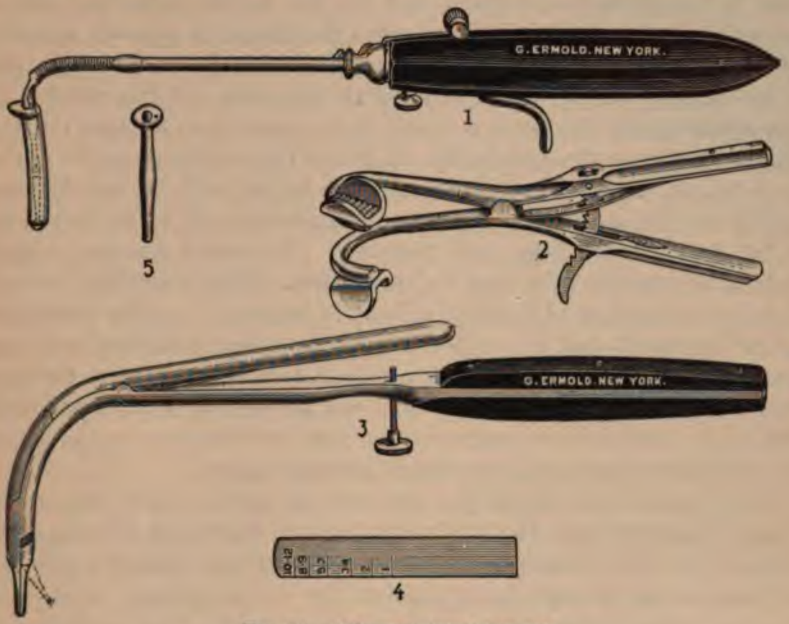

FIG. 71.—O'Dwyer's intubation set.
1, introductor; 2, gag; 3, extractor; 4, gauge; 5, tube.

The index finger of the left hand is used as a guide in introduction. This is passed well back into the pharynx, then brought forward until a hard nodule—the upper border of the cricoid cartilage—is encountered. This is the best of all landmarks, since the soft parts are often distorted by swelling. Directly in front of the cricoid cartilage may be felt the epiglottis and the opening of the larynx, which are readily recognised after the touch has become somewhat educated. The tube is passed along the palmar surface of the left index finger, by which it is guided into the larynx; it is then pushed off the introductor by a thumb-piece attached to its handle. When it is certain that the tube is in position, and the patient breathes properly, the loop of silk attached to the head of the tube is cut off and pulled through, the removal of the tube being prevented by placing the left forefinger upon its head. The silk should not be left attached unless there is evidence of loose membrane below the tube. It may then be fastened to the cheek by a piece of adhesive plaster. The tube is known to be in place, first, by the hissing breathing sounds, somewhat similar to what is heard when the trachea is opened; secondly, by a severe paroxysm of coughing, which is usually excited by a tube in the larynx; thirdly, by the relief of the dyspnœa. If this relief is not very apparent the physician may still be in doubt as to whether the tube is in the larynx or the œsophagus. If in the former, it can not be pushed down by the finger without depressing the larynx with it; and by introducing the finger into the pharynx, the posterior wall of the larynx can be felt between the finger and the tube. The most common mistake made is to pass the tube into the œsophagus. This sometimes happens because the position of the child's head is improper—too far forward or too far backward—but more often because the operator has not been quite sure of his landmarks. If this has occurred, there is no relief to the dyspnœa, no hissing sound, and the tube can be pushed down indefinitely. When this condition is recognised, the tube is withdrawn by the loop of silk and after a few moments a second attempt made.

False passages in the larynx are most frequently made because the operator has worked at the angle of the mouth instead of keeping in the median line. The tube usually goes into one of the ventricles, and may be pushed quite through the larynx into the cellular tissue. This is not likely to happen unless undue force has been used. The production of a false passage is recognised by the fact that, although the tip of the tube can be felt to enter the larynx, it does not descend, but projects above the epiglottis.

False membrane which has become loosened is sometimes crowded down by the tube and obstructs the larynx just below it. This is one of the most serious accidents that may occur, but fortunately it is not a frequent one. It is more liable to happen where the disease has existed for several days than in recent cases. The tube may be in place in the larynx as shown by all the signs above mentioned, except relief of the asphyxia. In such a case the immediate withdrawal of the tube is necessary; it being often followed by the discharge of masses of loose membrane. This is aided by the administration of a teaspoonful of pure whisky or brandy to excite a strong cough. Artificial respiration may be required, and if there is no relief by any of these means tracheotomy is indicated. Asphyxia is sometimes produced by prolonged and injudicious attempts at introduction.

After-treatment.—So far as the tube itself is concerned no treatment is required. The original disease is to be treated as before. The operation has removed only one danger from the patient, viz., that of asphyxia from mechanical obstruction of the larynx. A good expulsive cough should occur after the tube is in place. This is necessary to clear the tube of mucus, as the pharynx and larynx are generally filled with it as a result of the manipulation.

The child should not be allowed to lie upon its face, nor should it be held over the nurse's shoulder face downward, for in either position a slight cough is enough to expel the tube. Nursing infants may continue at the breast after the operation; ordinarily they have but little difficulty in swallowing. Older children often experience considerable trouble in taking liquids. This may be overcome by the device suggested by Casselberry (Chicago), of having the patient's head lower than his body while he drinks. If there is still trouble in taking fluids, semi-solid articles, such as condensed milk, wine jelly, corn starch, or scrambled eggs, may be tried. Feeding is always easier after the first day or two, and patients who wear a tube for chronic disease soon experience no trouble whatever, showing that the difficulty depends more upon the inability to co-ordinate the movements of the muscles of deglutition when the tube is in place than upon mechanical causes, for the head of the tube is effectually covered by the epiglottis.

It sometimes happens that the tube is coughed out soon after its introduction, because too small a size has been used. In some cases this occurs repeatedly. It happened in a case of my own twenty-eight times during four days. Such cases are probably due to paralysis of the laryngeal muscles. The dyspnœa does not usually return for two or three hours after the tube has been coughed out, so there is ample time to notify the physician. It may happen that the tube is coughed up and not seen by the nurse, or it may be coughed up and swallowed by the child. When called because of dyspnœa after operation, the physician should make a digital examination of the pharynx to be sure that the tube is still in place. Swallowing the tube generally causes no harm to the child, for tubes have repeatedly passed through the intestines.

The entrance of food into the bronchi through the tube is a danger that does not exist, as has been shown by the extensive post-mortem observations of Northrup in the New York Foundling Asylum. My own experience in the New York Infant Asylum coincides in every particular with his statement, that the broncho-pneumonia following intubation does not depend upon the entrance of food into the bronchi.

Ulceration at the head of the tube very rarely occurs, provided properly made tubes are employed.* The tube rests not upon the vocal cords, but upon the inferior ventricular bands. When ulceration occurs, it is usually of the anterior wall of the trachea, at the lower end of the tube, and appears to be produced by the movements of the tube during deglutition. With O'Dwyer's latest tubes there is much less liability of this occurring. The ulcers are usually small and superficial. Deep ulcers extending to the tracheal rings may be seen in ill-conditioned children, usually in connection with other complications severe enough to cause death.

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* This and many other bad results obtained after intubation are due to improperly constructed instruments. Those made by George Ermold, 312 East Twenty-second Street, New York, are perhaps the most reliable.

Spontaneous descent of the tube into the larynx is impossible, and it can not be crowded down without using considerable force and severely lacerating the larynx.

Sudden blocking of the lower end of the tube by membrane loosened from the trachea or bronchi is an infrequent accident. The usual result of this is the immediate expulsion of the tube by coughing, the discharge of the loose membrane following. This condition is one of the safety valves of the operation. One of the strong points in favour of intubation is that the forcible cough which the patient is able to make on account of the narrow opening of the tube, often enables him to expel large accumulations of mucus, and even membrane, more readily than through a much larger tracheal opening.

In membranous laryngitis the tube is usually left in place from four to seven days, longer in very young children. Should the tube be coughed out at any time, its introduction should be delayed until dyspnœa returns. If this happens on the third or fourth day, a second introduction is often unnecessary.

The removal of the tube.—This is rather more difficult than its introduction. The general arrangement of the patient and assistants is the same as for introduction. The left index finger is placed upon the head of the tube, which is steadied externally by the thumb of the same hand. The beak of the extractor is introduced within the opening of the tube, its jaws are then separated by pressure upon the lever at the handle, and the instrument withdrawn, very slight force being required.

The tube is first removed tentatively, the physician waiting to see if dyspnœa returns. It is well to give an opiate an hour before the removal of the tube, since the contact with the air almost invariably excites a marked degree of laryngeal spasm which lasts for ten or fifteen minutes. To avoid the production of vomiting and the entrance of food into the larynx, food should not be given for two hours previously. If dyspnœa does not return in the course of three or four hours, the probabilities are that the tube will no longer be required. It is very exceptional that the patient has great difficulty in dispensing with the tube, as so often happens after tracheotomy.

The advantages over tracheotomy.—The advantages claimed by O'Dwyer for this operation over tracheotomy are conceded by most of those who have had any considerable experience in the operation, viz.: (1) It is quicker, simpler, and adds no danger to the original disease; (2) there is no shock or hæmorrhage; (3) no anæsthetic is required; (4) no fresh wound is made which may prove an avenue of infection; (5) it gives an opportunity for a better expulsive cough, which is of great value in dislodging false membrane and mucus; (6) there are usually no objections on the part of the parents to be overcome—a point of great importance; (7) the air is warmed and moistened as it is normally, by passing over the nasal and buccal mucous membranes; (8) no skilled after-treatment is required: as the largest proportion of the cases of diphtheria are among the very poor, living under conditions in which the careful after-treatment required in tracheotomy is difficult or impossible to obtain, this is an important point; (9) in infancy, all who have had experience with both operations admit the great superiority of intubation; (10) the intubation tube can be dispensed with earlier than the tracheal canula, and also with much less difficulty; (11) if tracheotomy is subsequently required, the operation may be done upon the tube as a guide.

The only objection of much force urged against intubation is that asphyxia may be produced by crowding down loose membrane into the larynx. This is a very infrequent accident; should it happen, and the asphyxia not be relieved by coughing up the membrane, tracheotomy may be performed.

Experience has clearly proved that intubation relieves the dyspnœa due to laryngeal stenosis promptly, efficiently, certainly; it does this without many of the dangers and objectionable features of tracheotomy, while at the same time it does not deprive the patient of any essential advantage which tracheotomy affords.

The use of antitoxine in the treatment of diphtheria has so shortened the period of stenosis that tracheotomy as a routine operation is hardly justifiable. The great superiority of intubation is now generally admitted not only in America, but all over the continent of Europe, where it has practically displaced the older operation.

SUBMUCOUS LARYNGITIS—ŒDEMA OF THE GLOTTIS.

These two conditions are not quite identical, although they are closely associated and may be conveniently considered together. They are both rare in early life. In true œdema of the glottis there is simply a dropsical effusion into the submucous cellular tissue of the aryteno-epiglottic folds, causing them to project as large rounded swellings on either side of the superior isthmus of the larynx. They may be of sufficient size to cause serious or even fatal obstruction to respiration. With the laryngoscope they appear as pale red tumours, lying usually in contact near the base of the tongue. By the finger their presence can be quite as readily distinguished. Œdema of the glottis occurs principally in the late stages of nephritis.

In the inflammatory form of œdema, or true submucous laryngitis, there is the same sort of swelling of these structures, but in this case it is due to some active inflammation in the neighbourhood. The swelling is partly from the œdema and partly from cell infiltration. Usually all the parts surrounding the upper opening of the larynx are in a state of acute inflammation. The epiglottis may be swollen to the thickness of a finger, and easily seen by depressing the tongue.

The *exciting causes* may be the mechanical irritation of foreign bodies, the inhalation of steam or irritating gases, erysipelas of the neck, primary catarrhal laryngitis, or retro-pharyngeal abscess.

The *symptoms* in both cases consist in great inspiratory dyspnœa with attacks of suffocation, while expiration may be quite easy. In true œdema there are in addition the symptoms of the original disease. In the inflammatory form there are the evidences of local inflammation—hoarseness, cough, pain, and difficulty in swallowing. A positive diagnosis may be made by a digital examination. The symptoms develop with great rapidity in either variety, and frequently prove fatal in a few hours.

The *treatment* of true œdema consists in scarification or multiple puncture, the application of ice externally, and even the swallowing of ice; in the inflammatory form, in addition, local blood-letting by leeches and, as a last resort, tracheotomy. Intubation is useless in either form.

CHRONIC LARYNGITIS.

The following varieties are seen: (1) a simple form usually associated with adenoid vegetations of the pharynx; (2) tuberculous; (3) syphilitic; (4) that associated with new growths.

1. **With Adenoid Vegetations of the Pharynx.**—This is not very uncommon. The larynx is kept in a state of chronic congestion by the adenoid growth, and there finally develops a sight superficial catarrhal inflammation. The symptoms may continue for many months. These cases are often treated for a long time unsuccessfully by the use of sprays, inhalations, etc., but the symptoms disappear rapidly after the removal of the adenoid growth. Similar symptoms may be associated with hypertrophic rhinitis. In this also the treatment should be directed to the primary condition.

2. **Tuberculous Laryngitis.**—This belongs to later childhood, and is rare even then. In infancy it is almost unknown. Rheindorf * has reported a case in a child of thirteen months, which was regarded during life as syphilitic, but was shown by autopsy to be tuberculous. Of sixteen cases in children, reported by Rilliet and Barthez, none occurred during the first three years, and only four before the seventh year. The larynx alone may be affected, or the larynx and trachea, or the larynx, trachea, and lungs. Pulmonary tuberculosis is usually found to be present at autopsy,

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* Jahrbuch für Kinderh., Bd. xxxiii, p. 71.

even though there may have been no pulmonary symptoms. Demme has reported a case of tubercular laryngitis in a boy of four years, whose lungs were healthy, death resulting from tuberculous meningitis.

The *symptoms* are hoarseness, aphonia, laryngeal cough, and mucopurulent, sometimes bloody, expectoration. The sputum may contain tubercle bacilli. With the laryngoscope tubercular deposits may be seen, but more frequently tuberculous ulceration of the mucous membrane. In children this is usually superficial, the deep destructive ulceration seen in adults being very rare.

It is to be differentiated from syphilis chiefly by the general symptoms, as the laryngoscopic appearances may be very similar. The *treatment* consists in keeping the ulcers as clean as possible by the use of sprays and the local application of astringent powders, like nitrate of silver and sulphate of zinc or iodoform.

3. **Syphilitic Laryngitis.**—In the early stage of syphilis the larynx is often the seat of a catarrhal inflammation, which presents nothing especially characteristic except its protracted course. The laryngitis of late hereditary syphilis is quite rare, and is liable to be overlooked because of the difficulties in the way of a thorough examination, and because the disease is usually painless.

Strauss* has collected fourteen cases between the ages of three and fifteen years, and added three of his own. He states that deep-seated processes are much more rare than among adults. The parts most frequently affected are, first, the epiglottis; secondly, the aryteno-epiglottic folds; thirdly, the posterior laryngeal wall. The epiglottis was involved in twelve of fourteen cases. Usually there was only perichondritis; in the more severe cases there was partial or complete destruction of the cartilage. In four cases papillomatous masses were seen. In five cases the process extended from the epiglottis to the epiglottic folds of one or both sides. In several instances the superior vocal cords were thickened from hyperplasia, and occasionally small tumours were formed. In only one case was there ulceration of these folds. Changes in the vocal cords and the arytenoid cartilages were rare, occurring only with extensive inflammation. The symptoms are those of chronic laryngitis; hoarseness, sometimes aphonia, and in a few cases chronic laryngeal stenosis. The diagnosis can be made only by means of the laryngoscope. In most of the cases there are present ulcerations of the palate or uvula, or scars from previous ulcers; sometimes the disease extends into the nose. Serious symptoms often result when to old syphilitic lesions there is added acute laryngitis or œdema.

In addition to the usual constitutional remedies for tertiary syphilis, and to the means ordinarily employed for the relief of chronic laryngitis, intubation may be required in these cases for the relief of laryngeal stenosis. Nowhere are its advantages over tracheotomy more striking than here. The tube must usually be worn for many months.

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* Archiv für Kinderh., Bd. xiii.

NEW GROWTHS.

New growths of the larynx are not very rare in children. Excluding the granulations which follow the use of the tracheal canula, the only one that is likely to be met with is papilloma. This may occur even in infancy. According to Rauchfuss, the majority of the cases begin during the first year. Boys are more frequently affected than girls.

The *symptoms* depend upon the size and location of the tumour. The earlier manifestations are usually ascribed to chronic laryngitis. There is hoarseness, sometimes loss of voice, and a paroxysmal cough; later, dyspnœa develops. The symptoms are slowly progressive, and it may be several months before they are sufficiently severe to attract special attention. A positive diagnosis is made only by the laryngoscope. There is seen a whitish granular tumour, sometimes pedunculated, sometimes with a broad base, attached to any part of the larynx.

The *treatment* of these cases belongs to the specialist. Small pedunculated growths may be removed through the mouth by means of the forceps or snare. Larger ones require thyrotomy. The prognosis is generally unfavourable, on account of the danger of recurrence after operation. Operative measures may be followed by bronchitis or bronchopneumonia.

FOREIGN BODIES IN THE LARYNX.

The aspiration of foreign substances into the larynx is not a very rare accident in children. It usually happens from an attempt to cough, laugh, or cry while the child has something in its mouth. If the body is sharp and irregular, like a pin, the shell of a nut, or a fragment of bone, it is liable to become impacted in the larynx. If smooth, like a pea or a bead, it is usually drawn into one of the bronchi, generally the right.

When the body enters the larynx there is immediately excited a violent paroxysmal cough, with dyspnœa amounting almost to suffocation. Often the body is dislodged by this initial attack of coughing. If it becomes impacted in the larynx, it may cause sudden death by occluding the glottis; elsewhere it may excite acute laryngitis, usually of considerable severity.

The impaction of a foreign body in one of the primary bronchi, or one of the lobar divisions, is indicated by cough and a severe localized pain in the chest. There may be expectoration of blood. On auscultating the chest, there is found an absence of respiratory murmur over one lung or one lobe, according to the situation of the foreign body. Percussion gives increased resonance, which may even be tympanitic, owing to emphysema which rapidly develops. If the foreign body remains impacted in one of the bronchi, it usually excites a localized inflammation, which extends to the surrounding lung and terminates in the formation of an abscess. This may result fatally, or there may follow a prolonged illness, with hectic symptoms resembling pulmonary tuberculosis; and finally, after weeks or months, the foreign body may be expelled by an attack of coughing, and the patient recover completely.

The *diagnosis* of a foreign body in the larynx is made by the suddenness of the attack and the violence of the early symptoms. In older children the body may be seen with the laryngoscope, but in young children this is very difficult. The prognosis is always doubtful, and depends upon the nature of the foreign body and the point at which it has been arrested.

Treatment.—The first thing to be tried is inversion of the patient. By this means, assisted by the cough, the foreign body is not infrequently expelled, even though it has passed below the larynx. The symptoms of laryngeal obstruction may call for immediate tracheotomy or laryngotomy, intubation not being applicable to these cases. If, after tracheotomy, the foreign body can be located in the larynx, but can not be extracted through the tracheal wound, the thyroid cartilage should be divided in the median line. The removal of a foreign body from the bronchi or the tracheal bifurcation should be attempted only by a skilled surgeon.

CHAPTER III.

DISEASES OF THE LUNGS.

THE PECULIARITIES OF THE LUNGS IN INFANCY AND EARLY CHILDHOOD.

Thorax.—The general shape of the thorax is somewhat cylindrical, the conical or dome-shape of the adult not being attained until puberty. The antero-posterior and the transverse diameters are nearly equal in the newly born, but after the third year the transverse diameter is always greater, the difference increasing steadily up to adult life. On account of the shape of the chest, the lungs are situated rather more posteriorly in the infant than in the adult.

The thoracic walls are very elastic and yielding, owing to the cartilaginous condition of a large part of the framework. They are relatively thinner than in the adult, chiefly owing to the imperfect development of the thoracic muscles. The greater part of the thickness of the thoracic walls is due to the deposit of fat, generally abundant in well-nourished infants; but where the fat is scanty the walls are extremely thin. The capacity of the thorax is considerably encroached upon by the high position of the diaphragm, the large size of the thymus gland, and the frequent distention of the stomach and intestines.

Respiration.—According to Uffelmann, the rapidity of respiration during sleep at the different ages is as follows:

At birth	35	per minute.
At the end of the first year	27	" "
At two years	25	" "
At six years	22	" "
At twelve years	20	" "

During waking hours this rate is very materially increased, and from comparatively slight disturbance it may be nearly twice as rapid.

The type of respiration in infants is diaphragmatic, and it continues to be chiefly so until after the seventh year, when the costal element gradually becomes more and more prominent. The rhythm of respiration is easily disturbed. In very young infants the regular rhythm is seen only in sleep. The lungs do not always expand equally; at certain times and in certain positions respiration may be carried on for a few moments almost entirely with one lung. For some moments it may be very superficial, and then quite deep. The length of the interval between inspiration and expiration varies much at different times. Regular rhythmical respiration is not fully established before the end of the second year. After this time disturbances of rhythm are chiefly due to pulmonary or cerebral disease; but in infancy quite marked irregularity may have little or no significance. It is very common in all asthenic conditions.

Structure.—As compared with the adult, the trachea of the young child is larger; the bronchi are larger, more numerous, and occupy a greater space; the air cells are much smaller and occupy less space; and the interstitial tissue is much more abundant (Delafield).

Physical Examination.—This requires tact and time, but yields results which are quite as satisfactory as in adults. It should be undertaken only in a room having a temperature of about 72° F., or before an open fire.

Inspection.—This should be made with the chest bare. There should be noted, the shape of the chest, the presence of deformities from rickets, the want of symmetry in the two sides, bulging of the intercostal spaces, whether the two lungs expand equally or not, also variations in rhythm, and the presence and extent of any recession of the soft parts or bony walls as an indication of obstructive dyspnœa.

Palpation.—This also should be made upon the bare skin, always with the hand well warmed. Although we can not get the fremitus of the voice, we can get that of the cry. This is usually more intense than in adults, on account of the thinness of the chest walls. We frequently get a rhonchial fremitus—a vibration produced by mucus in the tubes. This may enable one to recognise bronchitis quite as positively as by the ear.

The position of the apex beat of the heart should be determined, it being remembered that in infancy this is normally in the mammary line, or just outside of it, and usually in the fourth intercostal space.

Percussion.—For the examination of the back, the child may be laid face downward upon the nurse's lap, or be seated upon her arm. For the front and the lateral regions of the chest, the child is most conveniently placed upon its side across a hard pillow. The percussion blow must be light, either with a single finger or a small percussion hammer, using a finger of the opposite hand as a pleximeter. Percussion should be made both during inspiration and expiration. The normal percussion note is somewhat tympanitic, this being due to the relatively large bronchi and the thin chest walls. This note is exaggerated in the interscapular region and beneath the clavicle, especially upon the right side. Here cracked-pot resonance may be obtained even in health. In early infancy the thymus gives dulness over the sternum as low as the third rib, sometimes even below this point, this gradually diminishing as age advances.

Auscultation.—This may be practised with the naked ear or with the stethoscope. A stethoscope is absolutely necessary for a thorough examination of the apices of the lungs in front and in the axillary regions. Most children are less frightened by the instrument than by the head of the physician during anterior auscultation. For the posterior part of the lungs, the stethoscope may be dispensed with. One with a small bell from half to three fourths of an inch in diameter is of great advantage. In auscultating with the ear it is not necessary to bare the skin. The physician should always auscultate the posterior part of the chest first, because he is most likely to find signs of disease there, and also because this is not so apt to frighten the infant. Every part of the chest should, however, be thoroughly auscultated, not omitting the high axillary regions. A convenient position for posterior auscultation is to have the child held over the nurse's shoulder.

The normal respiratory murmur of the infant is generally described as puerile. In quality this has been likened to the bronchial breathing of the adult, but the resemblance is not a very close one. It is rude, rather loud, and seems very near the ear. Its peculiar character is due to the fact that the tracheal and bronchial sounds are more distinct, because not transmitted through so thick a layer of lung and chest wall. It is especially loud in the regions where the bronchi are superficial, as between the shoulder-blades and beneath the clavicles, particularly of the right side. A careful comparison of the two sides of the chest will generally enable an observer to avoid errors. The irregularity of rhythm which occurs from slight causes should be remembered, and the infant's position changed several times during auscultation, to avoid the mistake of attaching too much importance to a feeble respiratory murmur of one side.

On account of the thinness of the chest walls, there is always great difficulty in distinguishing between râles produced in the bronchi and pleuritic friction sounds. Before drawing any inference from the auscultatory signs, both lungs must be examined for several minutes, changing the child's position, and often inducing a cry or compelling a deep inspiration by other means, in order to bring out signs which otherwise may be overlooked. As auscultation is extremely difficult or impossible in a crying infant, this part of the physical examination should first be made if the child be quiet, since upon it we must chiefly depend for diagnosis. Inspection and percussion can be deferred until later.

Peculiarities in Disease.—There are several peculiarities connected with the respiratory organs in infancy and early childhood which must be constantly borne in mind in studying their diseases. The muscular development of the thoracic wall is feeble. The soft, yielding character of the thoracic framework causes the chest to sink in readily from atmospheric pressure whenever there is obstructive dyspnœa. On account of the small size of the air vesicles, acute congestion may interfere with their function almost as completely as does consolidation. Because of the delicate walls of the air vesicles, emphysema is readily produced in obstructive dyspnœa, but it is rarely permanent. There is a tendency to collapse, either on the part of lobules or groups of lobules, but very rarely of an entire lobe. This is a much less important factor in the production of symptoms in acute pulmonary disease than many writers would lead us to suppose. The tendency of inflammation to spread from the large to the small bronchi is very much greater than in adults. In all forms of pulmonary disease the rapidity of respiration is much greater than in adults, on account of the rapid metabolism of the child. Areas of consolidation often exist without appreciable changes in the percussion note, because they are superficial and are surrounded by healthy or emphysematous lung. Flatness should always suggest the presence of fluid. Disease is often overlooked, from a failure to examine the whole chest.

Probably the most common mistakes are to confound bronchial râles with friction sounds, exaggerated puerile breathing with bronchial breathing, and to overlook the existence of fluid because of the presence of bronchial breathing.

ACUTE CATARRHAL BRONCHITIS.

Acute catarrhal bronchitis is one of the most frequent conditions for which the physician is called upon to prescribe in children. It occurs at all ages, from early infancy up to puberty. Its frequency, however, diminishes steadily after the second year. The predisposition to acute bronchitis exists with the same constitutional conditions, and is acquired in the same manner as the predisposition to the acute catarrhal inflammations of the upper respiratory tract. (See Acute Rhinitis). Bronchitis is very common in children who are suffering from rickets and malnutrition. It is much more frequent in the cold months, especially in the late winter and early spring, when there are sudden atmospheric changes and high winds.

Bronchitis may be a primary or a secondary disease. The primary form is excited by cold, exposure with insufficient clothing in severe weather, wetting of the feet, or chilling of the surface in any manner. Under these conditions it may occur alone, or be associated with or preceded by acute catarrh of the nose, pharynx, or larynx. In rare cases it is caused by the inhalation of irritants. Bronchitis is an almost invariable accompaniment of measles and influenza. It is very common in pertussis, in scarlet and typhoid fevers and diphtheria, and may occur in any acute infectious disease; it also complicates pneumonia and pleurisy. The relation of micro-organisms to the other etiological factors is the same as in the other acute catarrhs. (See Rhinitis).

Lesions.—Acute catarrhal bronchitis is an inflammation of the mucous membrane of the bronchi. As a rule it is bilateral, both sides being involved to the same degree. Localized bronchitis is secondary to some other pathological process in the lungs, usually tuberculosis or pneumonia. In acute bronchitis only the larger tubes may be affected, this usually being complicated with inflammation of the trachea (ordinary tracheobronchitis); or, in addition, the process may extend to the medium-sized tubes (severe bronchitis); or, in infants especially, it may extend to the smallest tubes (capillary bronchitis). In the last form there are invariably changes in the zones of air vesicles surrounding the bronchi, and these cases are therefore more properly classed as broncho-pneumonia. In the first form the inflammation is superficial, and affects only the mucous membrane of the bronchi. In the second form it may involve the entire thickness of the bronchial wall, and in the third form it does so regularly.

The pathological changes consist in congestion and swelling of the mucous membrane, desquamation of the epithelium, and an exudation of mucus and pus-cells. At autopsy the injection of the mucous membrane is usually distinct; pus and mucus line the walls of the larger bronchi, and by pressure ooze from the cut extremities of the smaller tubes. The chief lesion of the walls of the bronchi consists in an infiltration with leucocytes. In infants dying from bronchitis, the lungs are much more frequently emphysematous than collapsed. There is swelling of the lymph glands at the root of the lung, which in most of the acute cases is slight, but in protracted cases, and after recurring attacks, may be quite marked.

Symptoms.—It is convenient to consider separately the symptoms in infants and in older children.

The bronchitis of infants.—1. The mild form (bronchitis of the larger tubes).—The onset is generally gradual, and the symptoms of bronchitis may be preceded by those of catarrh of the nose, pharynx, or larynx. The change in the character of the cough, the slightly accelerated breathing, and a further rise in temperature, indicate an extension to the bronchi. The cough may be constant and severe, or very slight. There is no expectoration. The secretions are usually coughed up into the mouth or pharynx, and swallowed. This sometimes excites vomiting. At other times the mucus is coughed only into the trachea or larynx, and aspirated again into the lungs. The respirations are from 40 to 50 a minute, and often accompanied by a rattling sound, due to mucus in the large bronchi or trachea. The general symptoms are not severe, and unless the infant is very young or very delicate no apprehension need be felt as to the outcome. The temperature is generally from 100° to 102° F. for two or three days, then below 100° F. There are a moderate amount of restlessness dependent upon the severity of the cough, usually anorexia, and sometimes vomiting and diarrhœa.

The physical signs in the first stage are dry, sonorous râles over the whole chest. A little later these give place to coarse mucous râles heard everywhere, but especially distinct between the scapulæ and in the infraclavicular regions. On palpation there is usually a marked rhonchial fremitus. Often there is not enough dyspnœa to cause recession of the soft parts of the chest. Unless the disease extends to the smaller bronchi and the air vesicles, the illness usually lasts about a week. Coarse râles in the chest may remain for some time after the symptoms have subsided. Relapses are exceedingly common. In a delicate or susceptible child, or in one whose surroundings are bad, one attack is likely to be followed by a succession of others, so that the child may not be really well until warm weather comes. The general health may suffer from the prolonged confinement to the house, although the patient may never have been seriously ill.

2. The severe form (bronchitis of the smaller tubes).—This differs from the preceding variety mainly in the greater severity of all its symptoms. The onset may be like that just described, the severe symptoms not appearing until the patient has been sick two or three days, or they may be severe from the outset. If the latter, it is indistinguishable from that of broncho-pneumonia. There are cough, dyspnœa, accelerated breathing, fever, and moderate, sometimes severe, prostration. The cough is tighter, and more frequently of a short, teasing character than severe and paroxysmal. There is difficulty in nursing. Dyspnœa may be quite marked and is shown by the active dilatation of the alæ nasi and the recession of all the soft parts of the chest on inspiration. The respirations as a rule are from 50 to 80 a minute. The temperature for the first day or two is usually 101° or 102°, but it may be 103° or 104° F. So high a temperature does not continue unless pneumonia develops. The prostration is in most cases more closely related to the dyspnœa and the rapidity of respiration than to the temperature. Often there is slight cyanosis.

In the beginning the chest is filled with sibilant and sonorous râles, many of them of a musical character. In twelve or twenty-four hours these are replaced by moist râles—coarse or fine, according as they are produced in the large or medium-sized tubes. There are often loud, wheezing râles on expiration. The respiratory murmur is feeble; the resonance on percussion is normal or slightly exaggerated. As the case progresses toward recovery, the finer râles are the first to disappear. The râles are always best heard behind, but they are present all over the chest.

At the onset of such a case it is impossible to say whether the disease will be limited to the medium-sized bronchi or will extend to the smallest bronchi and air vesicles. In young or very delicate infants, and during measles, it is very common for the disease to spread rapidly to the air vesicles. In other cases, usually in infants under six months old, there may develop attacks of respiratory failure or suffocation. These may occur in a severe case at any time, and, because of the infant's inability to empty the tubes of secretion, the dyspnœa steadily increases until the respiratory muscles are exhausted, the inspiratory force being too feeble to overcome the obstruction in the tubes. The symptoms which follow are usually ascribed to pulmonary collapse. I am, however, by no means certain that this is the correct explanation, for in autopsies made in such cases I have usually found the lungs to be the seat of acute emphysema. The clinical picture is a clear one. There is no disposition to cough or cry; the pulse is feeble; the respiration very rapid, superficial, often irregular; the skin cyanotic, and often clammy. Finally, there may be added to the others signs of carbonic-acid poisoning—dulness, apathy, and stupor. Such attacks may come on quite suddenly even in robust infants, and unless the treatment is energetic, even heroic, death often follows in a few hours, being frequently preceded by convulsions.

The usual course of the disease in infants previously in good health is that the severe symptoms continue for two or three days only, after which the temperature falls to 100° or 100·5° F., and gradually becomes normal. The constitutional symptoms usually decline with the temperature, and, except during the first thirty-six hours, they rarely give cause for anxiety. Recovery almost invariably occurs unless the disease extends to the finer bronchi.

Bronchitis is principally to be distinguished from broncho-pneumonia. The differential diagnosis is more fully considered under that disease. The most important points are that in pneumonia the temperature is higher and more prolonged, the prostration greater, the râles very often localized —being heard only behind, often over only one lung—the duration is more protracted, and all the symptoms are more severe.

The bronchitis of older children.—This is not nearly so serious as in infants, because the same danger does not exist of extension of the inflammation to the finer bronchi.

1. The mild form.—This is very common. The constitutional symptoms are slight, and often entirely absent after the first day. The patient is never sick enough to go to bed. The first symptoms are cough and soreness or a sense of oppression beneath the sternum. The cough is always worse at night. It is at first tight, hard, and racking; later it is loose, and in children over five years old there is usually expectoration—first of white, frothy mucus, but after a few days it becomes more abundant, and of a yellow or yellowish-green colour, from the presence of pus. The physical signs are only coarse râles, at first dry, and later moist, but heard over both sides of the chest, in front and behind. There may be some disturbance of digestion, anorexia, constipation, or diarrhœa. The usual duration of the attack is from one to two weeks. If the patient is not kept indoors the disease may pass into a subacute form, lasting for several weeks as a protracted "winter cough," but without any other important symptoms.

2. The severe form.—The onset is abrupt, with fever, chill, pains in the back, headache, cough, and sometimes pain in the chest. There is a feeling of tightness or constriction beneath the sternum. The onset resembles pneumonia, except that the symptoms are less severe. The temperature for the first two or three days ranges between 100° and 103° F. It is generally highest in the first twenty-four hours. The cough resembles that of the mild form, but it is usually more severe. The expectoration is more profuse, and occasionally, in the early stage, it may be streaked with blood.

The coarse râles of the mild form are present, and in addition there are finer râles—at first dry, and later moist—heard all over the chest. Frequently, wheezing râles are heard on expiration. The duration of the attack is ordinarily from two to three weeks, the patient being sick enough to be confined to bed for three or four days only. There is frequently a cough for some time after all physical signs have disappeared. Relapses are easily excited by any indiscretion before the patient has quite recovered.

The prognosis in the primary cases is good, such almost invariably terminating in recovery, and very exceptionally passing into broncho-pneumonia; but this not infrequently happens when the attack complicates measles or pertussis.

Treatment of Bronchitis. *Prophylaxis.*—To remove the predisposition to bronchitis the same means should be employed as those mentioned in acute rhinitis (page 430). General measures also should be adopted to build up the health of delicate infants. Those with tuberculous antecedents, and those who are especially prone to pulmonary disease, should if possible spend the winter in a warm climate. In all such patients the systematic administration of cod-liver oil should be continued throughout every cold season. The sleeping apartments of susceptible infants should not be too cold—never below 60° F.—but they must be well ventilated, best by an open fire. Such children should sleep in flannel night clothes, care being taken to see that the feet are always warm. While bronchitis of the large tubes is not *per se* a serious disease, it may become so by extension to the smaller tubes. It is consequently very important in infants and young children that these apparently mild attacks should not be neglected.

General management.—Every young child who has an acute catarrh of the nose, pharynx, larynx, or bronchi should be kept indoors. In every such catarrh accompanied by fever the child should be kept in bed while the fever lasts, even if the temperature does not go above 100·5° F., and is accompanied by no other constitutional symptoms. In infants and young children, many cases of bronchitis result from an extension of an acute rhinitis or laryngitis, hence this precaution is of more importance than everything else in preventing the extension downward of a catarrhal inflammation. A very large number of the cases will recover promptly when no other treatment is employed than to keep the child in bed. The temperature of the room should be about 70° or 72° F. It should be well ventilated and frequently aired, the child being removed to another room while this is done. Infants should not be allowed to lie for hours in the same position as there is a great advantage in changing from the crib to the nurse's arms. Careful attention should be given to feeding (page 190) and to the condition of the bowels. A cathartic, preferably castor oil, should be administered at the outset. Distention of the stomach and bowels with gas adds greatly to the discomfort of the patient, and may cause serious symptoms.

Abortive measures are rarely successful, for, by the time the physician is summoned, the disease is generally so well established that they are futile. Mild cases may sometimes be cut short by a hot foot-bath, free catharsis, and diaphoresis, especially by the use of phenacetine and Dover's powder (phenacetine three grains, Dover's powder one grain, to a child of three years).

Local applications.—Poultices are objectionable on account of their weight and the difficulty in getting them properly applied. For infants the oiled-silk jacket (page 59) is decidedly preferable. This should be applied in the beginning, and may be worn throughout the attack. It accomplishes all that a poultice does, with much less disturbance to the patient. Counter-irritation is very valuable. In infants the best results are obtained by the frequent use of a mustard paste (page 52). It should be large enough to envelop the chest, and covered by a towel, so as not to soil the oiled-silk jacket or the clothing. The paste is removed as soon as the skin is thoroughly reddened, which will be in from five to ten minutes, according to the strength of the mustard and the condition of the child's skin. The skin should then be dried and the oiled-silk jacket again pinned snugly about the chest. This may be repeated, according to indications, from two to eight times a day. If properly used, it may be continued for a week without causing any soreness of the skin.

Inhalations.—The value of these is not sufficiently appreciated. They may in the great majority of cases take the place of the administration of drugs by the mouth, a very great advantage in infants. They may be used by means of the croup kettle or vapourizer (pages 58 and 59), the child always being placed in a tent. In the early part of the disease relaxing inhalations, like simple watery vapour or limewater, may be used. Later turpentine, creosote, terebene, or eucalyptol may be added. Of these, creosote has given me the most satisfaction. Inhalations are to be used for ten or fifteen minutes from four to twelve times a day.

Expectorants.—In infancy this class of drugs may usually be advantageously dispensed with. For older children the relaxing expectorants, especially antimony and ipecac in combination, may be used in the first stage. When the secretion is more abundant, either the alkaline or the stimulating expectorants may be given. Of the former, the best are liquor potassæ, citrate of potassium, and muriate of ammonia; of the latter, creosote, turpentine, terebene, and squills. Small, frequently repeated doses usually give the best results.

Opium.—This should be given very cautiously to young infants, as it is capable of doing great harm. The dry, harassing cough of the early stage sometimes yields to nothing so quickly as to small doses of Dover's powder (e. g., one tenth of a grain every two hours to a child of one year). In the case of infants, late in the disease, and especially in severe cases, opium should be withheld altogether. It disturbs the stomach, constipates the bowels, and, most of all, it greatly depresses the respiration.

Emetics may sometimes be used with advantage when the secretion is very abundant and the cough feeble, but they should be avoided with weak pulse, great prostration, and slight stupor. Syrup of ipecac is the best emetic under these conditions.

Cardiac stimulants.—These are required in most of the severe cases. The best is alcohol. It should be begun as soon as indicated by weak pulse and general prostration. For a child a year old, from half an ounce to one ounce of brandy, diluted with from six to eight parts of water, should be given in each twenty-four hours, in small doses at short intervals.

Respiratory stimulants.—The most valuable drugs are strychnine and atropine. To an infant of six months $\frac{1}{400}$ grain of strychnine and $\frac{1}{1200}$ grain of atropine may be given every two hours. For a short time twice these doses may be used. They are needed only in the most severe cases, and may be used in combination or alternately. An important respiratory stimulant is counter-irritation over the entire body by the mustard paste or hot mustard bath.

The management of mild cases in infants.—In the great majority of cases the disease is self-limited, tending to spontaneous recovery. Often no treatment is needed, except the hygienic measures mentioned. An oiled-silk jacket should be applied. If the cough is excessive, inhalations of creosote or turpentine three or four times a day may be used, or small doses of Dover's powder or phenacetine. The oppression which often comes on toward evening may be relieved by a mustard paste at bedtime. Stimulants are not required. All other drugs may be advantageously omitted, but during convalescence cod-liver oil should be given.

The management of severe cases in infants.—These must be treated very much like cases of broncho-pneumonia. The temperature is rarely high enough to require interference, but the chief danger is due to the inability of the child to get rid of the secretion by the cough. In my experience the two most valuable means of treatment have been the use of inhalations and counter-irritation. The former should be repeated for ten or fifteen minutes every two hours, and for a short period may often be given with advantage every hour. Early in the disease, vapour of plain water or limewater may be used; later, creosote is best. Counter-irritation by the mustard paste should be repeated every three hours, and the oiled-silk jacket worn continuously. Alcoholic stimulants are usually needed in delicate children, and in secondary bronchitis accompanying the infectious diseases. In most of the cases the medication should consist only of cardiac and respiratory stimulants. In strong children the occasional use of an emetic at bedtime is admissible.

Attacks of suffocation and respiratory failure.—The indications here are to get as much blood as possible to the surface and to the extremities, in order to relieve the overloaded right heart, and to compel the child to make full and deep inspiratory efforts. One plan of treatment (Jacobi's) is to induce frequent crying by flagellation or spanking, this being kept up for several hours. Another (H. C. Wood's) is to use alternately hot and cold douches to the chest until some reaction is obtained, and then to follow up this by the occasional use, for a few moments, of a very hot bath (120° F.). Both these means, but especially the first mentioned, are of great value, as I have had abundant opportunity to verify. Another useful measure is the hot mustard bath, or the hot mustard pack applied to the entire body. In conjunction with the above means, both heart and respiratory stimulants should be given in full doses. If possible, oxygen should be administered. As these symptoms are liable to recur every few hours for a day or two, a repetition of the treatment will be needed, and if possible the physician should remain with the patient.

If a young infant can be tided over these critical attacks, recovery is probable. After this danger is past, the treatment previously indicated may be pursued. The use of expectorants, particularly the composite cough mixtures containing opium, can not be too strongly condemned in all severe cases of infantile bronchitis.

The management of cases in older children.—In the non-febrile cases confinement in bed is unnecessary, but children should be kept indoors. In the early stage, with hard, dry cough, one of the best remedies is brown mixture (the mistura glycyrrhizæ composita of the U. S. P.). It will be found advantageous in most cases to have the formula made up with one half the usual amount of opium. When the cough is especially hard and dry, a single inhalation may be used at bedtime. In the second stage, muriate of ammonia may be added to the mixture; or terebene, two or three drops upon sugar, may be given four or five times a day. Inhalations of creosote or turpentine should be used.

In the more severe cases accompanied by fever the patients should be kept in bed and an oiled-silk jacket applied. In the beginning the liquor ammoniæ acetatis and spiritus ætheris nitrosi may be given for their effect upon the skin and kidneys. For the general discomfort, pain, headache, etc., nothing is better than phenacetine and Dover's powder (three grains of the former to one grain of the latter to a child of five years), repeated every three to six hours. For the cough the same remedies may be used as in the mild cases. All patients should be kept in bed as long as the temperature is above normal. Subsequently, the cases may be managed as in the milder form of the disease.

The protracted cough of convalescence.—It often happens, both in infants and in older children, that after all physical signs and constitutional symptoms have disappeared, a cough continues sometimes for weeks. Expectoration is scanty, or is wanting altogether; the cough is hard, dry, often paroxysmal, and in some cases occurs at night only. For this condition the best remedies are quinine, cod-liver oil, and creosote. The last named may easily be given to young infants as well as to older children, in combination with liquid beef peptonoids.* It may be also used in pill form or by inhalation. These measures may be tried alternately or in combination. Where they are not effective a change of climate should be advised.

FIBRINOUS BRONCHITIS (BRONCHIAL CROUP).

Fibrinous bronchitis is seen in diphtheria, usually as an extension from the larynx or trachea. There is, however, another form of bronchitis attended by a fibrinous exudate, which occurs as a primary disease. This is very rare in children. Weil has, however, collected twenty cases of the primary form. The etiology is obscure. It is seen at all ages, from infancy up to puberty, and it may be either acute or chronic. From the cases thus far reported it would appear that the acute form is relatively more common in children than in adults. The disease may be confined to certain branches of the bronchial tree, or it may affect all the bronchi, even to the minute subdivisions. The fibrinous membrane is found loose in the tubes or adherent. There are generally associated other pulmonary changes, such as emphysema, areas of atelectasis or of broncho-pneumonia.

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* A preparation put up by the Arlington Chemical Company, and a very palatable way of giving creosote.

The acute form somewhat resembles ordinary catarrhal bronchitis. The diagnostic features are the severity of the dyspnœa and the expectoration of tube casts from the larger bronchi, or elongated cylinders from the smaller ones, the former resembling macaroni, the latter vermicelli. The expectorated masses are often in balls or plugs, and their peculiar character is not recognised until they are placed in water. The casts are dissolved by alkalies, especially by limewater. After the expulsion of a large cast, improvement in all the symptoms occurs. These, however, return as the exudate reappears. The ordinary duration of acute cases is from one to three weeks.

In the chronic form there are no constitutional symptoms, but only dyspnœa and cough, often recurring in paroxysms, with the expectoration of fibrinous casts. The patient may have these attacks at intervals of a few days or weeks, extending over a period of months, or even years. There are no characteristic physical signs. The diagnosis rests upon the peculiar character of the expectoration. The prognosis in acute cases is unfavourable, the mortality being 75 per cent (Weil). Chronic cases are not dangerous to life.

Treatment.—This is quite unsatisfactory. To loosen the membrane and facilitate its expulsion, the most efficient means are inhalations of the vapour of limewater and the internal administration of pilocarpine. Occasionally emetics are of value. Improvement in some of the chronic cases has resulted from the use of iodide of potassium.

CHRONIC BRONCHITIS.

Chronic bronchitis is not a common disease in children, particularly in young children, one reason being that chronic emphysema, so frequently an associated condition in adults, is rare in early life. Chronic bronchitis always accompanies chronic pulmonary tuberculosis and chronic interstitial pneumonia, with or without the occurrence of bronchiectasis. It is seen in chronic cardiac disease, especially with lesions of the mitral valve. It may occur as a late symptom of hereditary syphilis. Excluding the varieties mentioned, it usually follows attacks of acute bronchitis, the process becoming chronic because of the patient's constitutional condition or his unhygienic surroundings. The acute attack may be primary, but it often follows measles and whooping-cough. Rickets, general malnutrition, and lymphatism are the constitutional conditions in which acute bronchitis is most likely to pass into the chronic form. Deformities of the chest, the result either of rickets or of Pott's disease, are occasionally a cause.

Symptoms.—The only constant symptom is cough, which is persistent, obstinate, and nearly always worse at night or early in the morning. It often occurs in paroxysms strongly suggestive of pertussis. Expectoraconfinement in bed is unnecessary, but children should be kept indoors. In the early stage, with hard, dry cough, one of the best remedies is brown mixture (the mistura glycyrrhizæ composita of the U. S. P.). It will be found advantageous in most cases to have the formula made up with one half the usual amount of opium. When the cough is especially hard and dry, a single inhalation may be used at bedtime. In the second stage, muriate of ammonia may be added to the mixture; or terebene, two or three drops upon sugar, may be given four or five times a day. Inhalations of creosote or turpentine should be used.

In the more severe cases accompanied by fever the patients should be kept in bed and an oiled-silk jacket applied. In the beginning the liquor ammoniæ acetatis and spiritus ætheris nitrosi may be given for their effect upon the skin and kidneys. For the general discomfort, pain, headache, etc., nothing is better than phenacetine and Dover's powder (three grains of the former to one grain of the latter to a child of five years), repeated every three to six hours. For the cough the same remedies may be used as in the mild cases. All patients should be kept in bed as long as the temperature is above normal. Subsequently, the cases may be managed as in the milder form of the disease.

The protracted cough of convalescence.—It often happens, both in infants and in older children, that after all physical signs and constitutional symptoms have disappeared, a cough continues sometimes for weeks. Expectoration is scanty, or is wanting altogether; the cough is hard, dry, often paroxysmal, and in some cases occurs at night only. For this condition the best remedies are quinine, cod-liver oil, and creosote. The last named may easily be given to young infants as well as to older children, in combination with liquid beef peptonoids.* It may be also used in pill form or by inhalation. These measures may be tried alternately or in combination. Where they are not effective a change of climate should be advised.

FIBRINOUS BRONCHITIS (BRONCHIAL CROUP).

Fibrinous bronchitis is seen in diphtheria, usually as an extension from the larynx or trachea. There is, however, another form of bronchitis attended by a fibrinous exudate, which occurs as a primary disease. This is very rare in children. Weil has, however, collected twenty cases of the primary form. The etiology is obscure. It is seen at all ages, from infancy up to puberty, and it may be either acute or chronic. From the cases thus far reported it would appear that the acute form is relatively more common in children than in adults. The disease may be confined to certain branches of the bronchial tree, or it may affect all the bronchi, even to the minute subdivisions. The fibrinous membrane is found loose in the tubes or adherent. There are generally associated other pulmonary changes, such as emphysema, areas of atelectasis or of broncho-pneumonia.

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Treatment.—This is quite unsatisfactory. To loosen the membrane and facilitate its expulsion, the most efficient means are inhalations of the vapour of limewater and the internal administration of pilocarpine. Occasionally emetics are of value. Improvement in some of the chronic cases has resulted from the use of iodide of potassium.

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Symptoms.—The only constant symptom is cough, which is persistent, obstinate, and nearly always worse at night or early in the morning. It often occurs in paroxysms strongly suggestive of pertussis. Expectoration is not generally abundant, but in older children there is usually some expectoration present, and in a few cases it is profuse. A copious morning expectoration of fetid pus or muco-pus indicates bronchiectasis. There is no fever, little or no dyspnœa, and although the patients are thin they are not emaciated, and in many cases the general health is not much affected. There may be coarse mucous râles, or no physical signs whatever. The duration of the disease is indefinite, depending upon the cause. All these patients are better in summer and worse in winter, and suffer frequently from exacerbations of acute or subacute bronchitis.

The diagnosis is to be made mainly from pertussis and tuberculosis. From mild attacks of pertussis the diagnosis may be impossible except by the course of the disease. Tuberculosis may be suspected if the thermometer shows regularly a slight evening rise of temperature, if there is much anæmia, and steady loss of flesh. A positive diagnosis can be made only by the discovery of tubercle bacilli in the sputum.

Treatment.—The first indication is to treat the primary disease. In cardiac cases digitalis is the best remedy, and all sedatives are to be avoided. Attention should be directed to the general condition—rickets, malnutrition, and lymphatism each receiving its appropriate treatment. In most cases a general tonic plan of treatment is best, particularly the continuous use of cod-liver oil. In many cases a change of climate is the only thing which is really curative. For the relief of cough, opiates are to be avoided as much as possible. The main reliance should be upon potassium iodide, creosote and terebene, given both by mouth and by inhalation.

REFLEX COUGH—NERVOUS COUGH.

Strictly speaking, all cough is reflex and of nervous origin. The term "reflex cough" is, however, commonly used to denote that which occurs without any evidence of disease in the larynx, trachea, bronchi, lungs, or pleura. On account of the close nervous connection through the vagus and its branches between the mouth, ear, throat, stomach, and thoracic organs, it is possible for cough to be produced by many forms of irritation in these organs or cavities. Clinically, the following varieties of nervous cough are observed:

1. That dependent upon pharyngeal irritation. One cause of this is an elongated uvula. This cough occurs usually at night, and is tickling, hacking, or hemming in character. A similar irritation may be produced by the trickling of mucus into the lower pharynx from the nose or rhino-pharynx.

2. That due to aural irritation. This is rare, and may be associated with chronic otitis of any variety. It has no special characteristics.

3. That due to gastric irritation—the "stomach cough." This is much more frequent than the other forms. It is usually associated with chronic indigestion and occurs both in infants and in older children.

4. That due to dental irritation. The cough of dentition is often spoken of, although I have never seen a case which could fairly be ascribed to it.

5. Cardiac cough. This is usually associated with mitral disease, and due to pulmonary congestion. The cough is dry, hard, and often severe.

6. The variety which occurs usually about the time of puberty, and often associated with anæmia, chorea, or spinal irritation. It is a short, hacking, or teasing cough, sometimes very distressing, and it seems to be a manifestation of extreme nervous irritability.

7. The periodical night cough, which is generally ascribed to irritation of the vagus or its branches by enlarged, sometimes caseous, lymph nodes of the tracheo-bronchial group. This often occurs in severe paroxysms, the character of which is very much like pertussis. The attacks are apt to come on about the middle of the night and last for several hours. Vomiting is rare. The cough may recur regularly every night for months. On account of the loss of sleep the patient's general health may be considerably undermined.

8. A very similar cough may occur in connection with abscesses in the posterior mediastinum due to Pott's disease.

Symptoms and Diagnosis.—These cases are not common in infants, but are quite frequent in older children. In nearly all the varieties the cough is worse at night, and in many it may be confined to that time. The influence of habit is often seen, the attacks coming on regularly at certain periods. The general health may not be affected, except from the disturbance of sleep. The diagnosis between the different forms is often very difficult. The precise cause in a given case is discovered only by a careful examination of the ear, nose, pharynx, heart, stomach, lungs, and a consideration of the patient's general condition. The existence of enlarged or tuberculous bronchial glands may be suspected in patients of tuberculous antecedents, in those who have previously suffered from measles, pertussis, or repeated attacks of bronchitis, and when the cough is very severe and paroxysmal. A similar group of symptoms may exist with abscesses from Pott's disease. In either of these conditions there may be attacks of suffocation.

Treatment.—Opium and expectorants are not indicated, and inhalations are of little value. The only successful treatment is that which is directed to the cause of the disease. If no cause can be found, and the cough appears to be of purely nervous origin, the best results follow the use of the bromides or the administration of antipyrine at bedtime.

ASTHMA.

Asthma may be defined as a vaso-motor neurosis of the respiratory tract. It is characterized by attacks of severe spasmodic dyspnœa, which may be preceded, accompanied, or followed by bronchial catarrh of greater or less severity. In the asthmatic attacks of infancy the catarrhal element is very prominent, and these cases present quite a different clinical picture from the disease as seen in older children, which differs in no essential points from the asthma of adults.

Writers differ very much in their statements regarding the frequency of asthma in early life, mainly because of a want of agreement in regard to what shall be included under this term. The asthmatic attacks of infants are considered by some as a stage of bronchitis, by others as distinct from that disease. Typical attacks resembling those of adult life are rare in children, and extremely so before the seventh year. However, of 225 cases of asthma reported by Hyde Salter, the disease began before the tenth year in nearly one third the number.

Etiology.—The general or constitutional causes are the same in children as in adults. Asthma may be hereditary. It occurs especially in children whose antecedents have suffered from gout or from other neuroses. The local cause may be any form of irritation in the nose or pharynx—hypertrophic rhinitis, adenoid growths of the pharynx, hypertrophied tonsils, or elongated uvula—or in the bronchial mucous membrane, as a result of previous attacks of acute bronchitis. It is probable that it may also be caused by the irritation of enlarged bronchial glands. In susceptible persons a paroxysm may be excited by cold or damp air, indigestion, constipation, or the inhalation of various irritating substances, such as dust, the pollen of certain plants, etc. First attacks of asthma in children are apt to follow bronchitis.

Symptoms.—Four quite distinct clinical types of asthma are seen in children: (1.) Cases which in their onset simulate attacks of capillary bronchitis. (2.) Those in which asthmatic symptoms follow an attack of bronchitis, continuing for weeks or months, but not necessarily recurring. (3.) Hay fever, or the periodical form which occurs every summer. (4.) That which resembles the ordinary adult asthma, with the nervous element predominating. The prominence of the catarrhal symptoms is characteristic of all asthma of children, the first two varieties being peculiar to early life.

Attacks resembling capillary bronchitis.—These cases are rare, but may be seen even in infants. The onset is sudden, with moderate fever, incessant cough, severe dyspnœa, and sometimes symptoms of suffocation—cyanosis, prostration, and cold extremities. The chest is filled with sonorous, sibilant, and soon with subcrepitant râles. Instead of running the usual course of bronchitis of the finer tubes, the symptoms may pass away very rapidly, and in forty-eight, sometimes in twenty-four, hours the patient may be quite well. It is only by the course of the disease and by recurring attacks that their true nature can be recognised. In infants this form may be fatal.

Cases following attacks of bronchitis—Catarrhal asthma.—This form is not uncommon, though it is frequently designated by some other term than asthma—sometimes as spasmodic bronchitis, or catarrhal spasm of the bronchi. The symptoms are, however, indistinguishable from asthma, and they evidently belong in the same category. This form is usually seen in infants, being rare after the third year. Many of the patients are rachitic; others have large tonsils, or adenoid growths of the pharynx; while in still others there is every reason to suspect the presence of large bronchial glands. Usually there is nothing peculiar about the antecedent bronchitis; in most cases it is not especially severe, and is limited to the larger tubes. The febrile symptoms subside in a few days, but the cough continues, as do also the dyspnœa and wheezing. When the symptoms are fairly established they are very uniform and characteristic. The respiration is accelerated, usually to 50 or 60, sometimes to 70 or 80, a minute. The temperature from time to time may be very slightly elevated, or it may remain normal. The respiration is noisy, laboured, and accompanied by distinct wheezing, which can sometimes be heard all over the room.

On auscultation, there is prolonged expiration accompanied by loud, wheezing râles, either sonorous, sibilant, or musical, and occasionally moist râles are present. In cases which have lasted some time a moderate amount of emphysema can be inferred from prominence of the infraclavicular regions, and exaggerated resonance over the chest in front.

These symptoms and signs may continue for three or four weeks only, and gradually wear off, or they may last as many months—if they begin in the winter or spring, often continuing until the middle of the summer. While they are constantly present, they vary in intensity from time to time, being usually much worse at night. The symptoms are always increased by exposure to a cold, damp atmosphere, by any fresh accession of bronchitis, and often by trivial digestive disturbances. The usual duration of the cases I have seen has been two to six weeks. The cough is not usually severe, and expectoration in most cases is absent. The general health is often but little affected. With recovery from the asthmatic symptoms the emphysema usually disappears gradually, although I have seen one severe case in which it persisted.

What proportion of these children afterward develop ordinary asthma, from personal experience I am unable to say. Some undoubtedly do, but in others which I have been able to follow, recovery has seemed to be permanent. This would appear more likely in those cases closely associated with rickets, or with other causes which disappear spontaneously with time or as a result of treatment.

Hay fever.—This is very rare before the seventh, and but few well-marked cases are seen before the tenth year. In its clinical aspects it does not differ essentially from the disease as seen in adults, except possibly by the greater prominence of the bronchial catarrh.

Ordinary attacks of the adult type.—These usually occur at intervals of a few weeks or months, depending upon the nature of the exciting cause. The beginning is usually at night, with dyspnœa, a short, dry cough, and loud, wheezing respiration. Deep recession of the soft parts of the chest is seen, as in laryngeal stenosis. There is prolonged expiration, accompanied by loud, sonorous, sibilant and wheezing râles, and the vesicular murmur is very feeble. Later, moist râles may be heard. After many attacks emphysema is present. This occurs more rapidly than in adults, and may be extreme, giving rise in marked cases to serious thoracic deformity. On account of the loss of sleep and interference with nutrition, the general health may become seriously impaired.

Diagnosis.—Typical attacks of asthma are easily recognised. Some of the catarrhal forms seen in infancy, however, present great difficulty, and a positive diagnosis may be impossible except by the progress of the case.

Prognosis.—This is best in the cases of catarrhal asthma in infants, and in older patients when it depends upon some local cause which can be removed, as when the disease is due to reflex nasal or pharyngeal irritation. In the majority of other cases, asthma is likely to become chronic unless the child is removed to some climate in which the attacks do not occur. The younger the child, the shorter the duration of the disease, and the less marked the hereditary tendency, the better the prognosis.

Treatment.—The nose and the rhino-pharynx should be carefully examined in every case of asthma, and any pathological condition there present should be removed as the first step in the treatment. Special importance, in children, should be attached to the removal of adenoid growths of the pharynx. During attacks, the best means of relieving the symptoms is the inhalation of fumes of nitre paper or stramonium leaves. Most of the proprietary remedies (Papier de Fruneau, Himrod's cure, and Kidder's pastilles) contain these ingredients. The two preparations last mentioned are by most children particularly well tolerated. The sleeping room may be filled with the fumes from these substances, or the child may be placed in a tent into which the fumes are introduced. Emetics should be employed when the attack is brought on by indigestion. Lobelia is the most satisfactory remedy for this purpose. To prevent the recurrence of night attacks, nothing in my experience has been so valuable as a full dose of antipyrine at bedtime—four grains at five years and six grains at ten years. Between the attacks the main reliance should be upon the syrup of hydriodic acid and potassium iodide, which are to be given for a long time in full doses. Tonics are to be used in nearly all cases. Those especially valuable in asthmatic patients are cinchonidia and arsenic.

In the cases of catarrhal asthma following bronchitis, expectorants and ordinary cough remedies are useless. Cod-liver oil and the iodide of potassium are valuable in some of the cases. Others get much relief from the regular use of creosote inhalations several times a day, with a nightly dose of antipyrine. The fumes of nitre and stramonium often afford no relief, and sometimes the cases are made distinctly worse by them. The best of all measures is to send the child at once to a warm, dry climate.

For all children who have had repeated attacks, whether in the form of hay fever or the ordinary variety, the most important thing is removal to a place where they do not have the disease, and a residence there long enough to break up the tendency to recurrence. This will usually require at least three or four years. The region best suited to most asthmatics is one which is high, dry, and moderately warm. Patients often suffer less in cities than in the country. If taken early, asthma in children is frequently curable by these means; if neglected, the disease is almost sure to continue until adult life.

CHAPTER IV.

DISEASES OF THE LUNGS.—(Continued.)

PNEUMONIA.

IN early life the lungs are more frequently the seat of organic disease than any other organs in the body. Pneumonia is very common as a primary disease, and ranks first as a complication of the various forms of acute infectious disease of children. It is one of the most important factors in the mortality of infancy and childhood (page 39).

Cases of acute pneumonia are divided, from an anatomical point of view, into two principal groups: (1.) Broncho-pneumonia, also known as catarrhal and as lobular pneumonia. (2.) Lobar pneumonia, also known as croupous and as fibrinous pneumonia. These differ from each other as to the products of inflammation, the distribution of the disease in the lung, and somewhat as to the parts involved and the nature of the changes in them.

In broncho-pneumonia the large bronchi are the seat of a superficial inflammation, while in those of small size the entire bronchial wall is affected; the exudation into the air vesicles is mainly cellular, being made up of epithelial cells, leucocytes, and red blood-cells (Fig. 72), fibrin being either absent, or present only in small amount. In many cases there are marked changes both in the alveolar septa and in the interstitial tissue of the lung; resolution is often imperfect, and there is a strong tendency of the inflammation to pass into a chronic form, involving the connective-tissue framework of the lung. The lesion is widely and often irregularly distributed, usually being most marked in

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the vicinity of the small bronchi, from which the inflammation spreads, and in the most superficial lobules of the lung.

In lobar pneumonia, bronchitis, when present, is usually superficial, the walls of the bronchi being very slightly or not at all affected; the same is true of the alveolar septa. The principal product of the inflammation is fibrin (Fig. 73), which fills the alveoli and the terminal bronchi, the cells being relatively few and chiefly leucocytes. The process is usually sharply circumscribed, involving an entire lobe or a part of a lobe. In most cases it clears up rapidly and completely, there being but little tendency to involve the framework of the lung in a chronic process.

While in typical cases the two forms of inflammation are quite distinct, there are seen many intermediate forms which partake of the characters of both, and one may be in doubt, even after a microscopical examination, into which group to place a case. It not infrequently happens that both varieties of pneumonia are present in different parts of the same lung or in opposite lungs at the same time. These mixed forms are especially frequent during the second and third years; but during the first year, and after the third, the types are usually well marked.

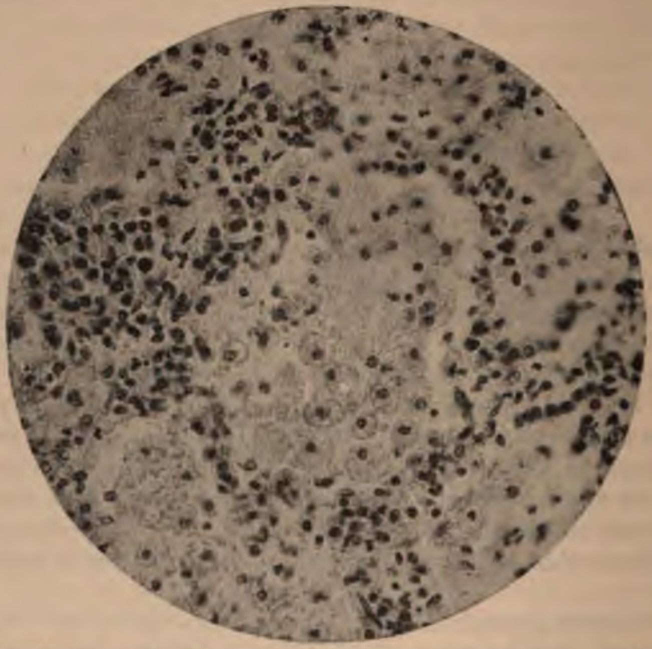

FIG. 72.—Broncho-pneumonia. The picture shows at its centre one entire air vesicle, and at its margin parts of four or five other vesicles; they are filled with large epithelial cells having small nuclei. There are also seen leucocytes with intensely black nuclei and narrow protoplasm. Between the cells is a finely granular material, which is the exudation fluid coagulated during the hardening process. The alveolar septa are somewhat infiltrated.—From Karg and Schmorl.

The following table shows the relative frequency of lobar and broncho-pneumonia in three hundred and seventy cases,* nearly all taken from one institution (New York Infant Asylum). There are included all the cases of acute primary pneumonia occurring during a period of seven years:

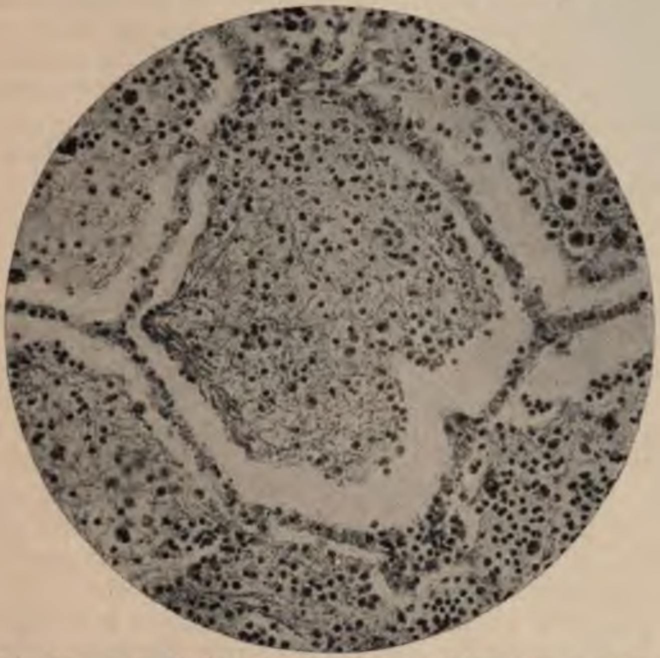

FIG. 73.—Lobar pneumonia. In the air vesicle shown in the picture there is a firm, close network of fibrin, in the meshes of which are leucocytes. At the lower part the exudation has contracted away from the wall in consequence of the process of hardening.—From Karg and Schmorl.

Under six months,	broncho-pneumonia,	73	cases;	lobar	pneumonia,	11	cases.
Six to twelve "	"	96	"	"	"	29	"
Second year,	"	73	"	"	"	40	"
Third "	"	19	"	"	"	23	"
Fourth "	"	0	"	"	"	6	"
Totals,	"	261	"	"	"	109	"

Thus it will be seen that, of the cases of acute pneumonia occurring during the first two years, 25 per cent were lobar and 75 per cent were broncho-pneumonia.

When we come to a consideration of the micro-organisms with which the different forms of pneumonia are associated, we find that they do not correspond to the anatomical varieties. Lobar pneumonia is regularly associated with the presence of the pneumococcus (micrococcus lanceolatus), which in most cases is found pure. In broncho-pneumonia no one form is always present. In the primary cases the pneumococcus is usually found, and in many cases it is alone. In the secondary cases there is almost always mixed infection. In measles and diphtheria the streptococcus is the principal form, such cases being usually of the worst type. In other secondary cases there are found the staphylococcus, and sometimes Friedländer's bacillus. Each of these varieties of bacteria may be found alone, but they are often associated, and with any of them may be found the pneumococcus, or other specific germs, most frequently the bacillus of influenza, diphtheria, or tuberculosis.

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* The division was here made according to the predominant clinical or pathological features. Most of the doubtful cases were classed as broncho-pneumonia.

The reason why the same cause—the pneumococcus—in one case produces broncho-pneumonia and in another lobar pneumonia, is in part owing to the difference in the structure of the lung at the different ages—that of infancy being more bronchial, and that of older children more vesicular (page 460). Another reason is to be found in the constitution of the patient: in the very young and in feeble and delicate children, the process tends to become diffuse and the products are chiefly cellular; in those who are older and more vigorous it is likely to be circumscribed, with fibrin as its chief product; in the intermediate ages and intermediate conditions the types are often mingled.

Etiologically as well as clinically, lobar pneumonia is a single disease, usually running a regular self-limited course. Broncho-pneumonia, on the other hand, includes a number of quite distinct diseases, which are not only etiologically but clinically different. Sometimes when it is due to the pneumococcus it has more features in common with lobar pneumonia than with cases of broncho-pneumonia due to another kind of infection, such as the streptococcus.

The immediate source of infection of the lungs is the mouth, the nose, or the pharynx. All the forms of bacteria found in pneumonia are found in these cavities, some of them constantly, others only at certain times, especially during an attack of any of the acute infectious diseases. What part direct contagion plays in the spread of pneumonia can not be settled without fuller data than at present exist. There seems to be no doubt, from clinical observations alone, that the secondary forms, especially those complicating measles and diphtheria, are sometimes communicated in this way. This is probably not often true of primary cases, except in hospitals for infants where the rapid development of case after case in the same ward can not be well explained on any other hypothesis.

The different forms of pneumonia which will be considered are: (1) Acute broncho-pneumonia. (2) Acute fibrinous pneumonia. (3) Acute pleuro-pneumonia. (4) Hypostatic pneumonia. (5) Chronic broncho-pneumonia.

Tuberculous broncho-pneumonia will be discussed in the chapter devoted to Tuberculosis.

ACUTE BRONCHO-PNEUMONIA.

Synonyms: Catarrhal pneumonia, lobular pneumonia, capillary bronchitis.

This is essentially the pneumonia of infancy. Under two years, the great majority of the cases of primary pneumonia are of this variety, and throughout childhood nearly all the cases of secondary pneumonia. The term broncho-pneumonia describes a lesion rather than a disease, several quite distinct forms of infection being included under this head. Its mortality is high, because of the tender age of the patients in which the primary cases occur, and also because when secondary it complicates the most severe forms of the acute infectious diseases of children.

Etiology.—*Age.*—The 426 cases of broncho-pneumonia of which I have notes occurred as follows:

During the first year	224	cases, or	53	per cent.
" " second year	142	" "	33	" "
" " third "	46	" "	11	" "
" " fourth "	10	" "	2	" "
" " fifth "	4	" "	1	" "
	426		100	

After four years broncho-pneumonia is very infrequent as a primary disease, although it is seen throughout childhood as a complication of the infectious diseases.

Sex.—In the primary cases males are more frequently affected than females, the proportion being five to four. In the secondary cases the sexes are about equally affected.

Season.—Of the cases referred to, 38 per cent occurred during the winter months, 31 per cent during the spring, 13 per cent during the summer, and 18 per cent during the autumn. While, therefore, nearly 70 per cent of the cases occurred in the cold months, broncho-pneumonia is seen throughout the year.

Previous condition.—Broncho-pneumonia affects all classes, but is most frequent in children having poor hygienic surroundings, especially in inmates of institutions, and in those previously debilitated by constitutional or local disease. In 246 consecutive cases of primary pneumonia, 110 were in good condition prior to the attack, and 126 were delicate, rachitic, or syphilitic.

Previous disease.—The following table gives a good idea of the conditions with which acute broncho-pneumonia is most frequently seen; 443 cases were classed as follows:

Primary[*]	164
Secondary to bronchitis of the large tubes	41
Complicating measles	89
" pertussis	66
" diphtheria	47
" acute ileo-colitis	19
" scarlet fever	7
" influenza	6
" varicella	2
" erysipelas	2
	443

A large number of the patients had previously suffered from one or more attacks of bronchitis, and fifteen previously had broncho-pneumonia.

As an exciting cause, exposure to cold must still be classed among the potent factors of primary pneumonia.

Bacteriology.—Much light has already been thrown upon broncho-pneumonia by bacteriology, but many points still remain to be settled. In 1889 Prudden and Northrup[†] showed that the broncho-pneumonia of diphtheria was usually due to the streptococcus. In 1891 Mosny[‡] published a report upon 17 cases of broncho-pneumonia: 4 were primary, 7 were secondary to measles, 3 to diphtheria, and 1 to scarlet fever. In the 4 primary cases, the pneumococcus was found alone in 3, and the streptococcus alone in 1. In the 11 secondary cases, the pneumococcus was found in 3; in one of these, a case of measles, it was alone. The streptococcus was found in 10 cases—alone in 5, with the pneumococcus in 1, with the pneumococcus and Loeffler's bacillus in 1, with the staphylococcus in 2, with Friedländer's bacillus in 1; in one case Friedländer's bacillus was found alone, and in one case a peculiar streptococcus.

In 1892 Netter[#] published a report upon 42 cases. He has not separated the primary and secondary cases. Of 25 cases in which but one form of bacteria was found, the pneumococcus was present in 10, the streptococcus in 8, the staphylococcus in 5, and Friedländer's bacillus in 2. In the 17 cases of mixed infection, the streptococcus was present in 15, the pneumococcus in 9, the staphylococcus in 8, and Friedländer's bacillus in 4.

I am indebted to Dr. Martha Wollstein, Pathologist to the Babies' Hospital, for permission to include here the results of observations made by her but not yet published. I had the opportunity of observing most of the cases clinically, they having been treated in my wards. Thus far 33 cases have been studied, 19 of which were primary and 14 secondary. Of the secondary cases, 2 complicated measles, 3 diphtheria, 3 marasmus, and 6 tuberculosis. The pneumococcus was found in 17 of the 19 primary cases, occurring alone in 9, with the streptococcus in 7, and with the staphylococcus in 1. Of the two remaining primary cases, the streptococcus was found alone in one, and with the staphylococcus in the other. Of the 14 secondary cases, the pneumococcus was present in 11, and alone in 2, both of these being cases of measles. The pneumococcus was associated with the streptococcus in 1 (a case of diphtheria), with the staphylococcus in 2 (both marasmus cases), with the tubercle bacillus in 2, with the tubercle bacillus and streptococcus in 3, with the tubercle bacillus and the staphylococcus in 1. Of the three cases in which the pneumococcus was absent, all showed the streptococcus—once alone, once with the staphylococcus, and once with the tubercle bacillus.

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[*] It is probable that a number of cases complicating influenza were included among these primary cases.

[†] American Journal of the Medical Sciences, June, 1889.

[‡] Étude sur la Broncho-Pneumonie, Paris, 1891.

[#] Archives de Médecine expérimentale, January, 1892.

Our present knowledge of the bacteriology of broncho-pneumonia may be summarized as follows: In the primary cases the pneumococcus is nearly always present, and in a large proportion of the cases it occurs alone. In cases of mixed infection it is most frequently associated with the streptococcus. The secondary cases are usually due to a mixed infection. The pneumococcus is found in a large number of these cases, but plays a much less important part than the streptococcus, particularly in cases complicating measles, diphtheria, and scarlet fever. The staphylococcus is next in point of frequency in the mixed cases, and it may occur alone. Still less important is the part taken by Friedländer's bacillus both in primary and secondary cases. The association of the pneumococcus in all of the six tuberculous cases studied by Dr. Wollstein is of special interest, as it explains what is so often observed clinically, that in cases of tuberculous broncho-pneumonia the symptoms are indistinguishable from the simple form. Three of these cases ran the course of simple acute broncho-pneumonia, and were so diagnosticated during life.

We have not yet sufficient data definitely to connect the different forms of infection either with any set of lesions or with any group of clinical symptoms. The cases due to streptococcus infection are usually the worst forms, and are apt to show widely disseminated lesions. The cases in which the onset and clinical history resemble lobar pneumonia, and where there are found extensive areas of consolidation, and often excessive pleurisy, are usually due to the pneumococcus.

Lesions.—The term broncho-pneumonia is now generally adopted as a generic one, and it is to be preferred either to lobular or catarrhal pneumonia, as it gives prominence to the bronchial element in the inflammation. The process may begin in the larger tubes and gradually extend to those of smaller calibre, finally involving the pulmonary lobules in which these tubes terminate; or it may extend to the air vesicles which surround the tube in its course through the lung, so that in whatever direction the lung is cut, there are seen surrounding the small bronchi, zones of pneumonia (Fig. 74). In other cases the process seems to begin almost at the same time in the small bronchi and the air vesicles, as both are found involved, even when death occurs within a few hours of the first symptoms.

There are, however, cases in which the parts of the lung affected bear no relation to the bronchi—where there are found simply smaller or larger areas of pneumonia irregularly scattered through the lung, usually near the surface (Plate XII). From the distribution of the lesions such cases might better be termed lobular than broncho-pneumonia.

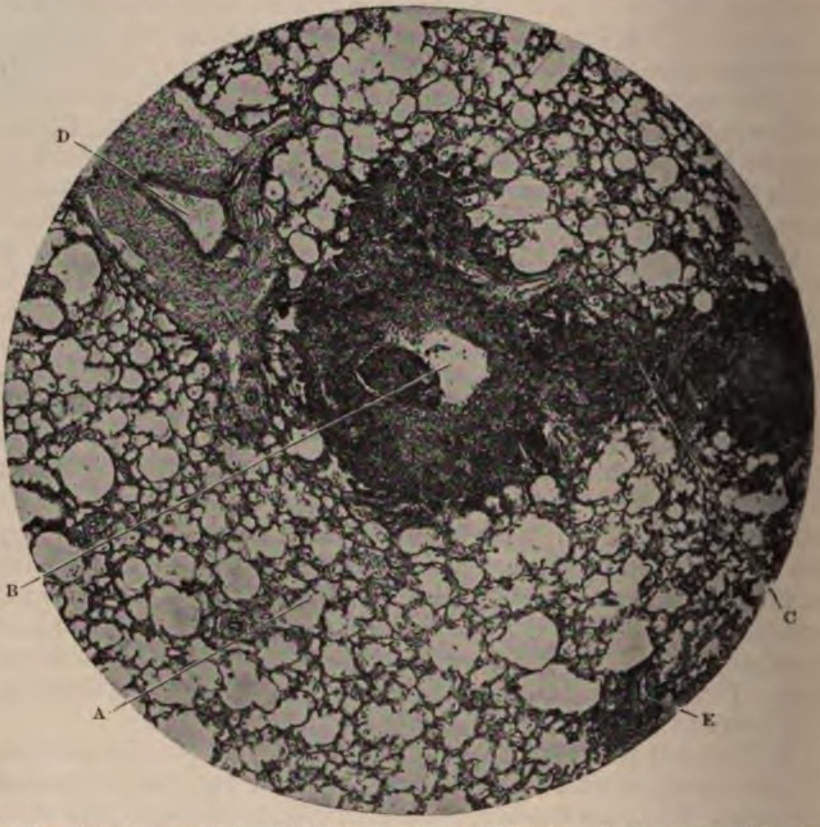
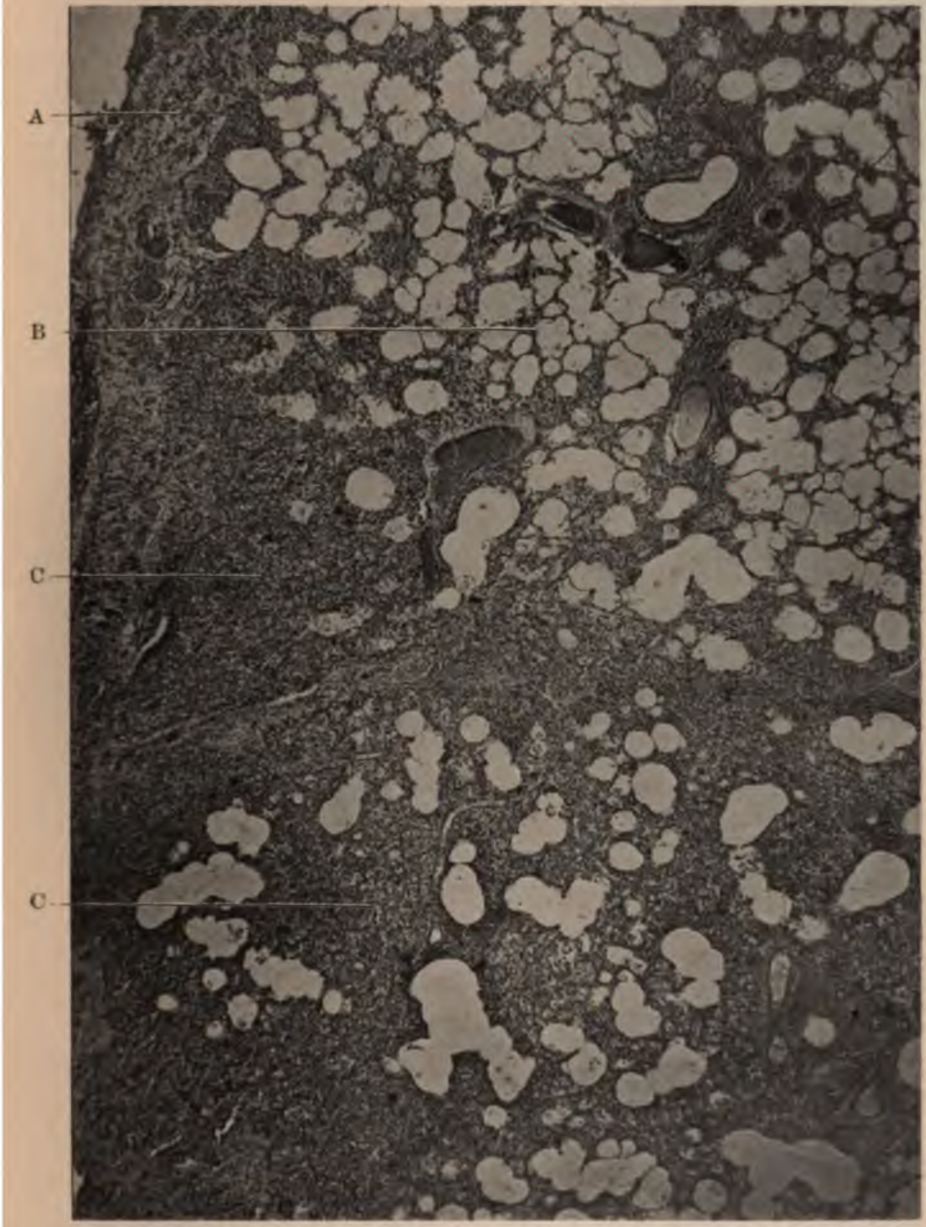


FIG. 74.—Broncho-pneumonia, with thickening of a small bronchus. In the centre of the picture is seen a small bronchus, B, which is cut somewhat obliquely, so that the degree to which its wall, C, is thickened is well shown. It is partially filled with pus, its mucous membrane is nearly destroyed, and its walls greatly thickened from infiltration with leucocytes. This infiltration extends to the lung tissue in the neighbourhood; it forms a peri-bronchitic zone of pneumonia. Elsewhere in the picture the lung tissue, A, is practically normal. D is a small blood-vessel. E is another smaller bronchus. Throughout the lung everywhere accompanying the small bronchi similar changes were seen, in addition to which there were present some large areas of consolidation. The disease was of four and a half weeks' duration; the child, five months old.

Much has been said in the past about pulmonary collapse from ob-



Acute Broncho-Pneumonia.

Primary pneumonia in a child two years old, showing the irregular distribution of the hepatization and its incomplete character. A is the pleura somewhat thickened; B, lung tissue which is practically normal; C C are hepatized areas, scattered through which are groups of air vesicles still containing air. (Slightly magnified.)

struction of the small bronchi, as an antecedent condition to this form of pulmonary inflammation. So far as my own observations go, there has been adduced but little evidence that this is the rule, or, indeed, that it often occurs. Even in autopsies made very early in the disease, but little collapse was found, most of the cases supporting the view of Delafield, that when the disease extends from the bronchi to the air cells it involves those surrounding the tube quite as regularly as those to which the tube leads.

The following observations are made from a study of 170 autopsies of which I have records, microscopical examinations having been made in about one third of the number.

Seat of the disease.—In 82 per cent of the autopsies extensive disease was found in both lungs. The parts most affected were the lower lobes posteriorly; next to this the posterior part of both the upper and lower lobes. The left lower lobe was more extensively diseased than the right in over two thirds of the cases. Only a single lobe was involved in but 9 per cent of the cases. It is not common for the disease to be situated in the anterior portion of the lung only, but when this occurs the right apex is the most frequent seat.

Just as the clinical symptoms of broncho-pneumonia follow no regular type, so the pathological process does not pass through a regular order of changes such as are seen in lobar pneumonia. There are a certain number of cases which appear to follow tolerably well-defined stages of congestion, red hepatization, gray hepatization, and resolution; but the disease may be arrested at any of the stages and the case recover, or death may occur at any stage and there may be found at autopsy different portions of the lung representing all the stages mentioned. In considering, therefore, the lesions of broncho-pneumonia, it seems best to describe the condition in which the lungs are found at the various periods when death is likely to occur, rather than to attempt to describe the different stages of the disease, as in lobar pneumonia.

1. *The acute congestive form* (*acute red pneumonia*).—This is the condition in which the lung is usually found if death occurs during the first two or three days of the disease. In the cases severe enough to cause death in the first twenty-four hours, very little can be seen by the naked eye except acute congestion. The vessels of the pleura are distended, and there may be small superficial hæmorrhages. Both lower lobes are usually heavy and dark-coloured. There is to the naked eye no consolidation. All, or nearly all, the lung can be inflated. On section, there is found intense congestion with some œdema. When the process has lasted a little longer the affected areas are more sharply defined. These, usually the posterior portions of both lungs, are of a brownish-red colour, and appear partially hepatized, although with a little force they may in most cases be inflated. After section, pus and mucus flow from the divided bronchi, and the whole lung may be more or less congested or œdematous.

The microscope alone reveals the fact that these are not cases of simple pulmonary congestion or bronchitis of the finer tubes. In one case in which death occurred twelve hours from the first symptoms, I found well-marked evidences of inflammation of the air vesicles. In these hyper-acute cases, the microscope shows great distention of all the small blood-vessels of the affected area, and small or large extravasations of blood just beneath the pleura, into the alveoli (Fig. 75) and interstitial tissue of the lung. In some cases these hæmorrhages form the most striking feature of the lesion. The air vesicles are partially, some almost completely, filled with red blood-cells, swollen and desquamated epithelial cells, and a few leucocytes (Fig. 72). The red blood-cells predominate. The inflammation may be diffuse, involving nearly a whole lobe, or in small areas in the

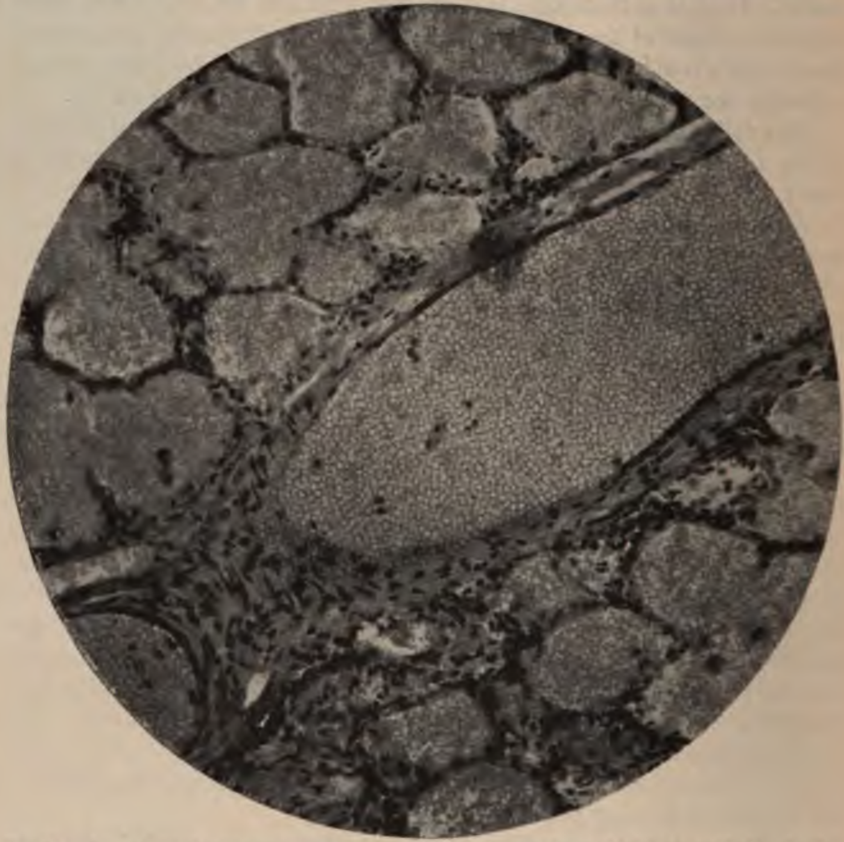


FIG. 75.—Acute broncho-pneumonia with intra-alveolar hæmorrhage (highly magnified). In the picture is shown a small vein, which, as well as the surrounding alveoli, is filled with blood-cells. In other respects the lung shown is normal. This is from the border of a consolidated area. Child fifteen months old: pneumonia of ten days' duration, with a severe exacerbation forty-eight hours before death, temperature 106° F. Extensive hæmorrhagic areas were scattered through the lung most affected.

neighbourhood of the small bronchi (Fig. 76). The mucous membrane of the large and small bronchi is the seat of catarrhal inflammation, and the walls of the latter are infiltrated with round cells.

When the process has lasted from twenty-four to forty-eight hours all the changes described are more marked, but the red colour of the inflammatory products still persists. Such cases give during life only the signs of congestion and bronchitis.

2. *The mottled red and gray pneumonia.*—This is the usual appearance when the disease has lasted somewhat longer, and is found in most of the cases dying between the fourth and fourteenth days. There are usually at this time quite large areas of consolidation, sometimes affecting nearly an entire lobe, so that at first sight the case may resemble lobar pneumonia. This is sometimes described as the "pseudo-lobar" form. The extent of these areas depends largely upon the duration of the disease. In most cases there is pleurisy over the consolidated portions. This may cause the lung to adhere to the chest wall, the firmness of the adhesions depending upon the duration of the process. The surface of the lung is usually of a mot-

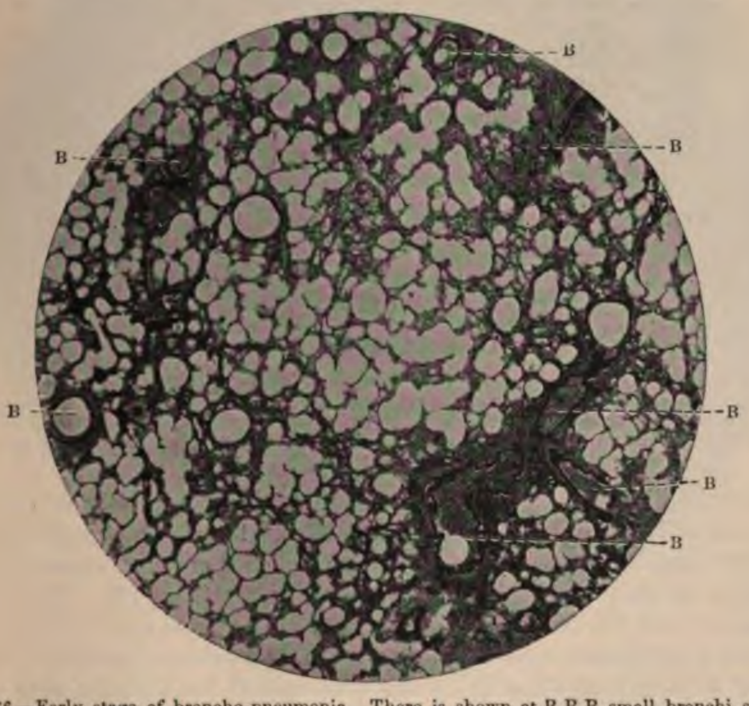


FIG. 76.—Early stage of broncho-pneumonia. There is shown at B B B small bronchi, some of which at the right of the picture have been cut somewhat obliquely, and hence appear irregular in shape. These bronchi everywhere contain pus; the air cells in the neighbourhood are partially filled with leucocytes. The intervening pulmonary tissue is normal. Child five months old.

tled red and gray colour; it often has a granular feel, due to the consolidation of some of the superficial lobules of the lung. On section, it is rarely found that an entire lobe is consolidated, the superficial portion being most affected, while the central part is normal or only congested. The colour is mottled, like that of the surface. In some places the hepatization appears complete; in others the hepatized areas are separated by healthy, congested, or emphysematous lung tissue (Fig. 77). The gray areas surround the small bronchi and vary in size from a pin's head upward. The smallest ones look very much like miliary tubercles. The larger ones are seen where the process has existed for a longer time and has gradually invaded the contiguous air cells. If the lung is cut parallel with the bronchi, there may be seen small gray striæ of pneumonia along their course (Fig. 74, C). From the cut bronchi, pus flows quite freely on pressure. The bronchial walls can often be seen even by the naked eye to be thickened. The parts affected are usually the posterior portions of the lower lobes of one side, the remainder of the lobes being congested or œdematous, while in front the lung is emphysematous.

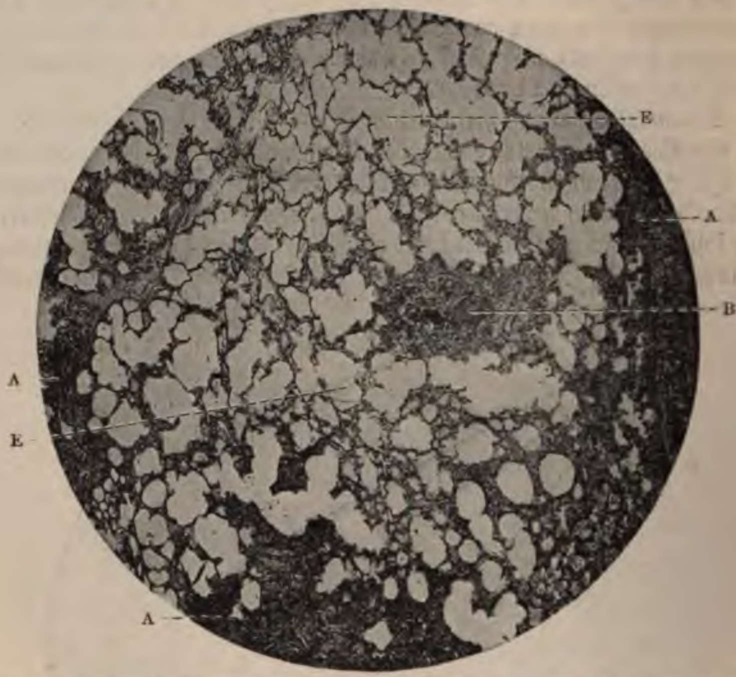


FIG. 77.—Acute broncho-pneumonia. In the centre is shown a small bronchus, B, with a zone of pneumonia about it. The greater part of the section is made up of emphysematous lung tissue, E E, showing dilatation of the alveolar spaces and rupture of some of the alveolar septa. At the border, A A A, are seen the margins of consolidated areas of lung.

Under the microscope the smaller bronchi (Figs. 74 and 78) are seen to be much thickened and infiltrated with leucocytes. The gray areas surrounding the bronchi are made up of groups of air vesicles, which are packed with leucocytes (Figs. 79 and 80). Fibrin is sometimes seen in small amount, also red blood-cells and desquamated epithelial cells, but the leucocytes predominate. Surrounding the areas densely infiltrated are groups of air vesicles which are normal or congested, or which show only the earlier stages of the inflammatory process. Under the microscope, even better than to the naked eye, is shown the irregularity of the consolidation.

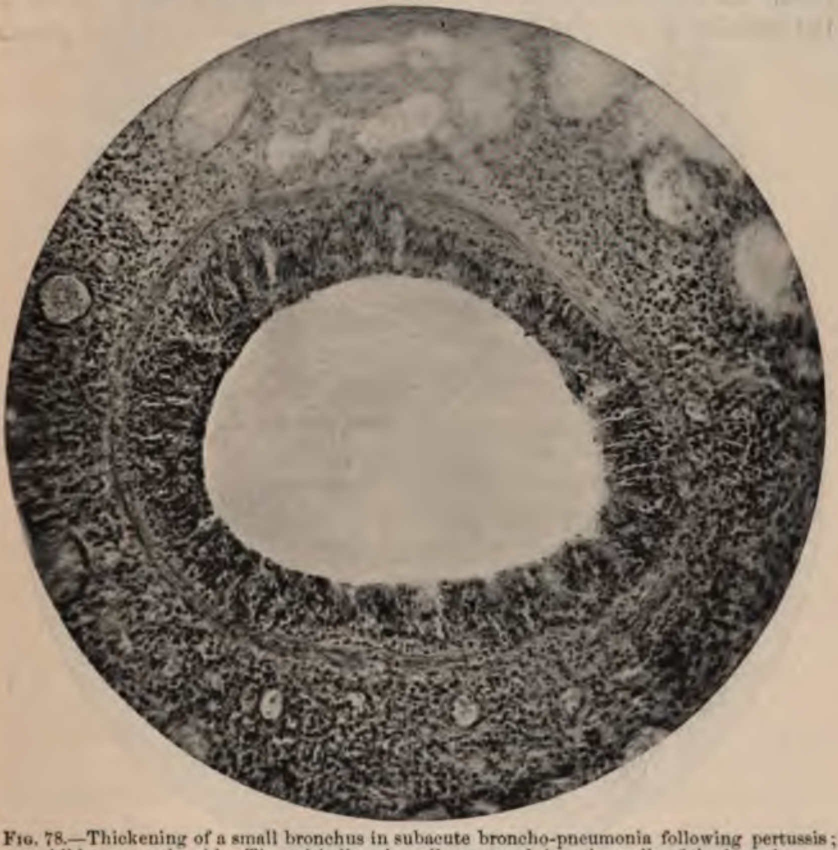


FIG. 78.—Thickening of a small bronchus in subacute broncho-pneumonia following pertussis; child ten months old. The epithelium is well preserved, but the walls of the bronchus are infiltrated with leucocytes and show some enlarged blood-vessels. Magnified about thirty diameters. All the small bronchi in the lung examined showed similar changes. In addition, there were superficial areas of consolidation in both lungs behind.

3. *Gray pneumonia* (*persistent broncho-pneumonia*).—This form is seen in protracted cases where there have been continuous symptoms usually for from three to eight weeks; it is not very uncommon. The pleuritic adhesions are more general and firmer. The amount of lung

involved may be very great, often nearly the whole of both lungs posteriorly. The affected lung appears completely consolidated and slightly enlarged. On section, it is of a nearly uniform gray colour, sometimes of a yellowish gray. On pressure, pus exudes from the smaller and larger bronchi. The bronchial walls are markedly thickened, and in some places there may be a slight dilatation of the smaller bronchi. The part of the lung not consolidated may be almost white, owing to vesicular emphysema. In some cases there is also interstitial emphysema. Small cavities containing pus may be found in the lung. The bronchial glands are frequently swollen to the size of a large bean, and are of a reddish-gray colour.

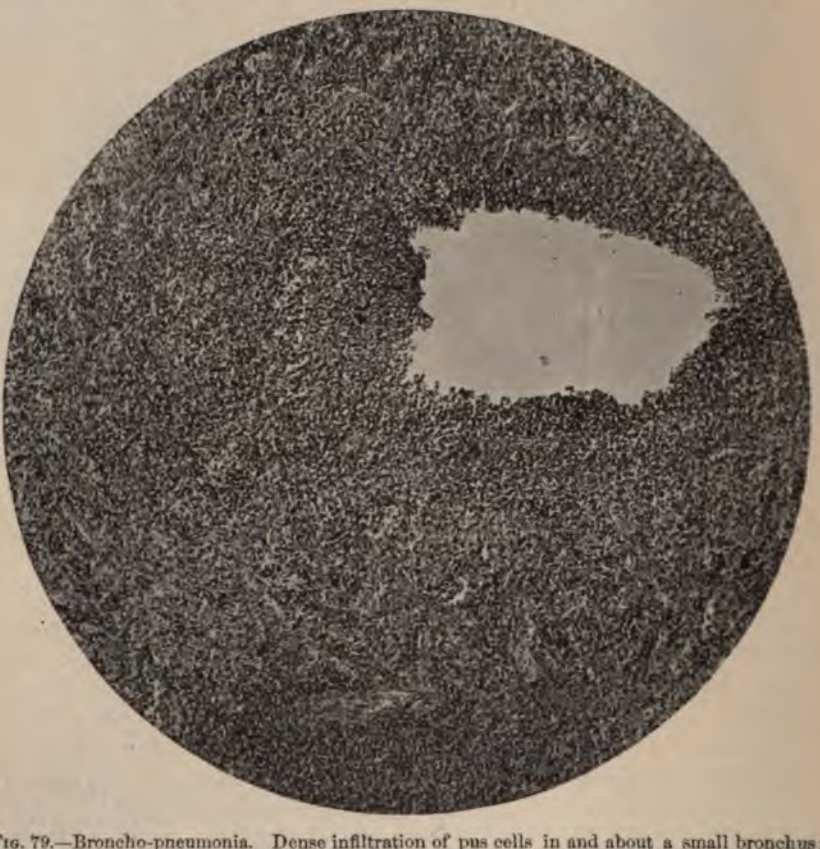


FIG. 79.—Broncho-pneumonia. Dense infiltration of pus cells in and about a small bronchus; under a low power. The cavity shown in the specimen is a cross-section of one of the small bronchi, which is partially filled with pus cells; the epithelium is destroyed. The bronchial wall and the pulmonary tissue in the neighbourhood are so densely infiltrated with leucocytes that almost every trace of normal structure is effaced. Child fifteen months old, disease of four weeks' duration. Extensive areas like this were found in both lungs.

The microscope shows that the air vesicles of the consolidated portions are distended chiefly with leucocytes, but there are also epithelial and connective-tissue cells. The alveolar septa may be so much thickened as to encroach upon the alveolar spaces (Fig. 81). Complete resolution is then impossible.

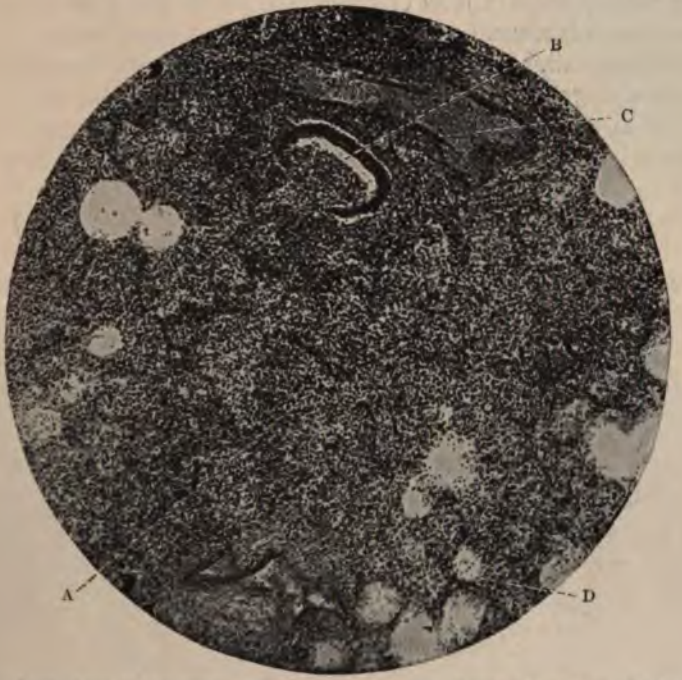


FIG. 80.—Acute broncho-pneumonia, under a low power, showing a portion of the lung, A, densely infiltrated with leucocytes. At B is a small bronchus, the wall of one side partly broken down by the inflammatory process. At the margin of the specimen D are seen alveoli more or less filled with epithelial cells and leucocytes. At C is a small blood-vessel. In other parts of the lung small gangrenous areas were seen. The disease was of nine days' duration, the child seven months old.

Terminations.—Death may occur at any stage, or the pathological process may be arrested at any stage and the case go on to recovery. Resolution may take place before any consolidation recognisable by physical signs has occurred; in such cases it is usually rapid and complete. If there has been consolidation, resolution may take place after two or three weeks and be complete, or it may be delayed for five or six weeks and still be complete. In many cases, especially those in which it is delayed, resolution is only partial, and there are relapses or recurring attacks. After the first, or after several attacks, there may develop a chronic interstitial pneumonia; or simple pneumonia may be followed by tuberculosis. Such cases as these are to be carefully distinguished from the much more frequent ones in which the broncho-pneumonia has been tuberculous from the outset.

Associated Lesions of the Lungs.—*Pleurisy* is almost invariably found over every large area of consolidation, and in cases of more than four days' duration; while in most of those fatal within the first two or three days the pleura is normal or only congested. It is seen in all grades of severity, from a slight gray film of fibrin that can hardly be stripped off, to a yellowish-green exudation one fourth of an inch thick. A small amount of serum—one or two ounces—in the pleural sac is not uncommon, but a large serous effusion is very rare. Cases in which there is an excessive inflammation of the pleura are considered elsewhere under the head of Pleuro-Pneumonia. Empyema occurs both during the stage of acute inflammation of the lung and while this is subsiding, but it is less frequent than in lobar pneumonia.

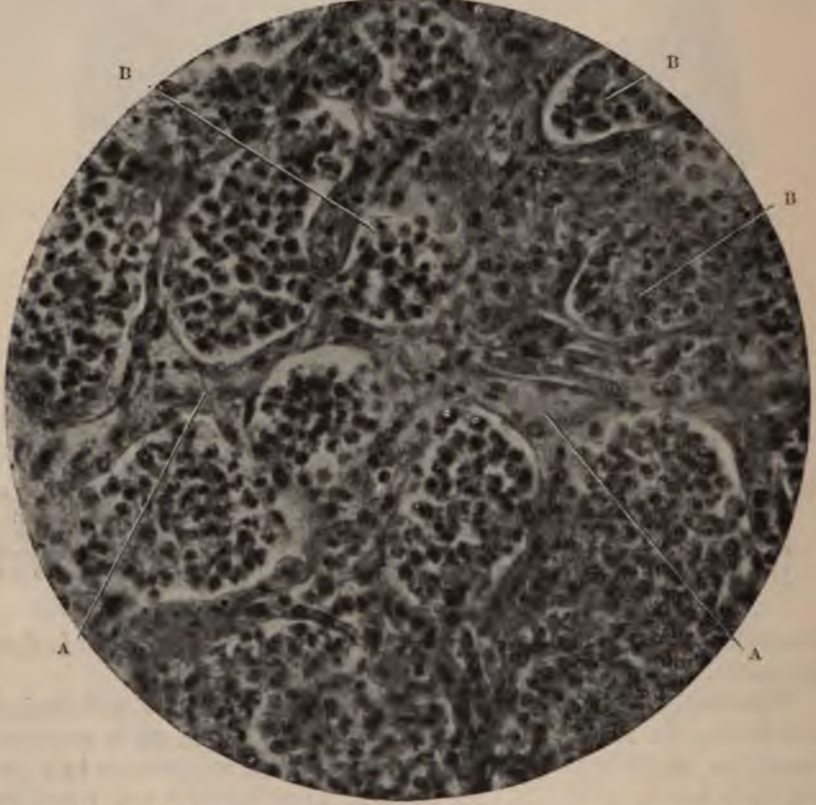


Fig. 81.—Persistent broncho-pneumonia; highly magnified. There are shown at A A marked thickening of the alveolar septa, encroaching upon the alveolar spaces. All the alveoli, B B, are densely packed with leucocytes. A similar condition also through nearly the whole of the affected lung. (For history and temperature, see Fig. 90.)

Bronchial glands.—In all the recent acute cases these are swollen and red; the usual size is that of a pea or a bean. They show microscopically the usual changes of acute hyperplasia. In protracted cases, and after repeated attacks, they may be two or three times the size mentioned, and of a gray colour. It is rare that they are large enough to give rise to symptoms unless they become the seat of tuberculous deposits.

Emphysema.—In almost all cases a certain amount of emphysema is present, it being more marked in the protracted cases. It is usually vesicular, involving the greater part of the upper lobes in front and the anterior margin of the lower lobes. Occasionally interstitial emphysema is seen, forming either large striæ upon the surface of the lung, or blebs of considerable size along the anterior margin. This may occur even in cases uncomplicated by pertussis or laryngeal stenosis.

Gangrene.—Gangrenous areas were found in six of my cases. In four of these the pneumonia was primary, in one it followed diphtheria, and in one ileo-colitis. It occurred in scattered areas of a grayish-green colour, varying from one fourth of an inch to two inches in diameter.

Abscesses of the lung are by no means uncommon. They were noted in seven per cent of my autopsies. They are usually minute and multiple, varying in size from one sixth to one half inch in diameter. Sometimes a portion of a lobe is fairly honeycombed with minute abscesses. In one case a large abscess was found occupying the greater part of a lobe, the symptoms resembling those of empyema. Abscesses are usually found in regions where the inflammatory process has been especially intense. They may be found in prolonged cases, in those of unusual severity, as shown by excessively high temperature and rapid extension of the disease, and in very delicate subjects. The microscope shows that these abscesses usually begin as an accumulation of pus in the small bronchi, whose walls become softened and break down on account of the intensity of the inflammation (Figs. 79 and 80). They may be superficial, but are more commonly in the interior of the lung; they contain yellow pus and sometimes broken-down lung tissue. Such abscesses can not be recognised clinically, and they are associated with other conditions which render the case almost certainly fatal.

The lesions in other organs will be considered under Complications.

Symptoms.—The clinical picture presented by broncho-pneumonia is an exceedingly varied one. There is no typical course. The cases differ from each other very markedly, but they may be divided into a few quite distinct groups.

1. *The acute congestive type.*—This may be seen at any age, but is more frequent in young infants. It may be either primary or secondary, being not uncommon in either form. Its symptoms are few and irregular, and the disease is often unrecognised. The entire duration may be only twenty-four hours. High temperature, extreme prostration, cyanosis, and rapid respiration may be the only symptoms. The temperature varies between 104° and 107° F., usually rising steadily until death occurs. The

prostration is extreme from the outset, the patient being overwhelmed by the suddenness and severity of the attack. Cyanosis is frequently present, and is almost always seen shortly before death. The respirations are from 60 to 80 a minute, but in most cases not strikingly laboured. Cough is frequently absent. Cerebral symptoms are often marked. There are dulness and apathy, sometimes quite profound stupor, and not infrequently convulsions just before death. The physical signs are few and inconclusive. There is often nothing abnormal except very rude breathing over both lungs behind; sometimes the breathing on one side is feeble, and on the other much exaggerated. There may be no râles whatever, and no change in the percussion note.

The suddenness and severity of these symptoms are something which it is hard for one who has not observed them to appreciate. I have known an infant to die in twelve hours from the time in which it was apparently in perfect health, and had an opportunity to confirm the diagnosis of pneumonia by a microscopical examination of the lung. The diagnosis can not be positively made during life, and in most of the cases the disease passes under some other name. It is often regarded as malignant scarlet fever or measles with suppressed eruption, or cerebro-spinal meningitis.

If the children are sufficiently strong to withstand the first onset of violent symptoms, they may recover completely in four or five days, the lung clearing up very rapidly. In other cases these grave symptoms may abate in a day or two, to be followed by those of ordinary broncho-pneumonia, which runs its usual course.

The symptoms of some of these cases may be explained by the sudden intense engorgement of the lung, which, owing to the small size of the air vesicles, interferes with its function almost as much as does consolidation. In other cases the symptoms are not so much due to the lungs, as the result of a general pneumococcus infection. A case lately came under my notice in which death occurred after a thirty hours' illness, where the pneumococcus was found by culture in both kidneys, spleen, heart's blood, and both lungs.

2. *Acute disseminated broncho-pneumonia* (*capillary bronchitis*).—Although the symptoms in this class of cases are chiefly due to the bronchitis, I have never failed to find at autopsy evidences of pneumonia also. These are not very common cases. The process begins as an inflammation of the medium-sized and small bronchi, but not of the finest bronchi. The onset is acute, with fever, very rapid and laboured breathing, severe cough, moderate prostration, and in most cases cyanosis.

The temperature is not high, usually only from 100° to 102° F., and it often continues so for three or four days. The pulse is rapid, and at first is full and strong. The respirations are exceedingly rapid, often from 80 to 100 a minute. There is dyspnœa with marked recession of all the soft parts of the chest during inspiration. Cough is always present, usually severe, and sometimes almost incessant. The prostration is not so great as in the cases previously described, and the development of the symptoms is much less rapid.

There are at first sibilant and afterward subcrepitant râles over the entire chest, with which are usually mingled coarser moist râles. There are no evidences of consolidation. The respiratory murmur is everywhere feeble, but not otherwise altered. Percussion generally gives exaggerated resonance, owing to the emphysema which is present, the note being sometimes almost tympanitic.

The symptoms may gradually increase in severity until death takes place by the third or fourth day, from respiratory and cardiac failure. There is usually marked cyanosis, and toward the end rapidly increasing prostration. Just before death the temperature often rises rapidly to 106° or 107° F. At the autopsy there are found evidences of bronchitis of the tubes of all sizes, and minute zones of pneumonia about the smaller bronchi. The lungs are generally in a state of hyper-inflation, on account of which they do not collapse on opening the chest. There may be in addition extensive congestion or œdema, the development of which has been the immediate cause of death.

In cases which do not prove fatal there is usually by the third or fourth day great improvement in the general symptoms; the finer râles may disappear, and the coarse ones become more and more prominent. By the end of a week there may be complete recovery. Instead of this, there may be a continuance of the constitutional symptoms, and disappearance of the fine râles in front only, while behind there are gradually added to them the signs of consolidation in one of the lower lobes near the spine. From this time the case may progress as one of ordinary broncho-pneumonia.

The prognosis in this class of cases is very much better than in the congestive variety, recovery being probable unless the patients are very young or very delicate infants.

3. *Broncho-pneumonia of the common type.*—When primary, this usually begins suddenly with symptoms not unlike those of lobar pneumonia. This was the mode of onset in two thirds of my cases. In only ten per cent was the pneumonia preceded by bronchitis of the large tubes. In these the symptoms of bronchitis may be slowly (Fig. 91, p. 504) or rapidly (Fig. 82) merged into those of pneumonia. When the onset is sudden it is marked by high fever, frequently by vomiting, rarely by convulsions. In addition there are rapid respiration, cough, prostration, and sometimes cyanosis. The symptoms are more distinctly pulmonary than is generally the case in lobar pneumonia.

The temperature, as a rule, is high; rarely is it continuously so, but it is of a remittent type. The daily fluctuations often amount to four or five degrees. The fever usually continues from one to three weeks, and

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gradually subsides. It is rare for it to terminate by crisis. Although, as a rule, we expect a high temperature with acute pneumonia, this is not invariable. Primary cases may run their course, and even terminate fatally, although the temperature has not been above 101° F. I have records of several such cases. A low temperature is more often seen in young and delicate infants than in those who are older and more robust.

The respirations are frequent and laboured; there is real dyspnœa. On inspiration, there are marked recessions of all the soft parts of the chest, and the alæ nasi dilate actively. The usual rapidity of the respirations is from 60 to 80 per minute; very often, however, it rises to 100, and on several occasions I have seen it even 120. Respiration generally seems more embarrassed than the action of the heart, and respiratory failure is a more frequent cause of death than cardiac failure. The pulse is always rapid—from 150 to 200 a minute—and when so it is often irregular. The pulse rate is of much less importance than its character. Early it is full and strong, but soon it becomes soft, compressible, and weak.

The prostration is usually moderate for the first day or two, but steadily increases as the lung becomes more and more involved. Toward the close of the disease there may be present all the symptoms of the typhoid condition.

Cough is much more constant than in lobar pneumonia, and more distressing; sometimes it is almost incessant. It disturbs rest and sleep, and may cause vomiting if the paroxysm occurs soon after eating. There is no expectoration. Mucus is sometimes coughed up into the trachea, or even the pharynx, to be swallowed again, or more frequently aspirated into the lung. If during a severe paroxysm the patient is turned upon his face or inverted, much of this mucus may be dislodged. A strong cough is a good symptom; suppression of the cough is always a bad symptom, indicating a loss of the reflex sensibility of the bronchial mucous membrane and feeble respiratory muscles.

Pain in the chest is not common, and is rarely an annoying symptom.

Cyanosis is present at some time in most of the severe cases. It may occur at the onset, or at any time during the course of the disease. It is usually due to sudden congestion of a portion of the lung not previously involved. Even when slight, it is always a danger-signal of respiratory failure, and when present only in the finger tips or lips indicates that the patient must be carefully watched and energetically treated. In the severe cases the whole body may be of a dull leaden hue.

Nervous symptoms at the onset are not so frequent as in lobar pneumonia, convulsions being rare; but late convulsions, particularly in the pneumonia which complicates pertussis, are exceedingly frequent, and usually fatal. Delirium may be present at any time during the attack. In infants this shows itself by excitement and inability to recognise the nurse or mother. Occasionally patients present marked cerebral symptoms throughout the disease. In one of my cases nearly every symptom of tuberculous meningitis was present, the autopsy revealing only an extreme degree of cerebral anæmia. As elsewhere stated, the nervous symptoms depend not upon the location of the disease, but upon its extent, the intensity of the infection, and upon the susceptibility of the patient, such symptoms being especially common in rachitic children and in those suffering from pertussis.

Gastro-enteric symptoms are frequent in infancy, and are of much importance. Often there are from four to six stools a day, of a green colour, containing mucus and undigested food. These symptoms depend upon the feeble digestion which is associated with the febrile process, and are often from improper feeding. This may lead to vomiting, which is also due to over-medication or to severe paroxysms of coughing. Vomiting and diarrhœa add much to the danger of the attack, and not infrequently, when the issue is doubtful, turn the scale against the patient. In summer this complication is more frequent and is likely to be more severe. Distention of the stomach or intestines from gas may be the cause of severe symptoms, owing to the added embarrassment of respiration produced by this upward pressure. In infants it may lead to attacks of cyanosis, and even convulsions.

The urine in most cases is scanty, high-coloured, and loaded with urates. A trace of albumin is often present when the temperature is very high; but casts, renal epithelium, and a large amount of albumin are rare.

The following temperature chart (Fig. 82) is a good example of a very frequent course of primary pneumonia of moderate severity terminating in recovery. In cases of this type the constitutional symptoms are not grave, and follow very closely the temperature curve.

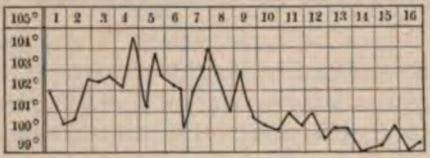

FIG. 82.—Temperature curve in typical broncho-pneumonia of the milder form.

History.—Male, sixteen months old; delicate child; previous bronchitis; onset gradual; signs of consolidation at left base on fifth day, but fine râles over both lower lobes behind; resolution slow, râles persisting for a long time in both lungs.

The next chart (Fig. 83) illustrates a more severe but not uncommon course of the disease in which the fever is prolonged. The usual duration of cases of this type is between three and four weeks. The irregular fluctuations of the temperature, rarely touching the normal line, are exceedingly characteristic of broncho-pneumonia.

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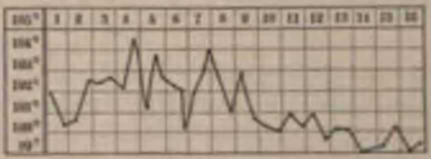

FIG. 82.—Temperature curve in typical broncho-pneumonia of the milder form.

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The chart shown in Fi
attack was fairly typical,

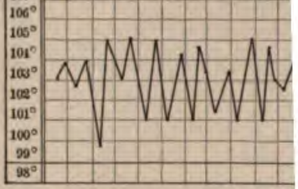

FIG. 83.—Temperature curve of

History.—Female, eighteen mo
localized, fine râles over left base; o
both sides behind. General sympto
about a week after cessation of fever

had begun, and was appare
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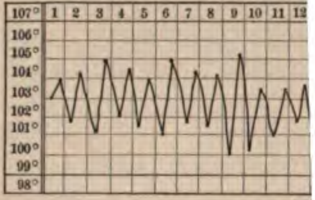

FIG. 84.—Temperature cu

History.—Male, nineteen months
behind; two days later small area of
sides; eighteenth day, signs of consol
sion of fever on nineteenth and twent
by new râles, but no evidences of con
valescence.

attack being shorter and mi
ture falls to normal without
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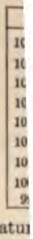

FIG. 85.—Temperatu

History.—Male, six months old; m
moist râles throughout the chest, mark
of consolidation in upper lobe of left lu
Autopsy.—No pleurisy; consolidation
lobe; consolidation of right apex poste

and other constitutional symptoms, the second attack frequently proving fatal.

A frequent course in fatal cases is shown in Fig. 85. The duration of the disease, instead of being five days as in this case, is often only three or four. The temperature at first fluctuates widely, then rises gradually until death.

Duration of the fever.—The following figures give the duration of the fever in 231 cases. The majority were primary; none were secondary to diphtheria, and only a few complicated measles. Of the 169 cases that were fatal—

There died during the first six days....................	25·0 per cent.
" " between the seventh and twenty-first days....	55·5 " "
" " " " twenty-first and sixtieth days....	19·5 " "
	100·0 " "

Of 78 cases which recovered, the duration of the fever was—

Less than seven days..................................	11·5 per cent.
From seven to twenty-one days..........................	66·6 " "
From twenty-one to ninety days.........................	21·9 " "
	100·0 " "

Physical Signs.—In considering the signs of broncho-pneumonia, it is better to connect them with the different conditions in the lung than to group them in stages, as in lobar pneumonia.

(*a*) *Without consolidation.*—It can not too often be repeated that broncho-pneumonia may exist without signs of consolidation at any period during the course of the disease. When the attack is primary, the earliest signs are due to congestion of the lung, associated with bronchitis of the fine tubes, which is usually localized, but which may be general. If the disease has followed bronchitis of the large tubes, its signs are added. Congestion of the lung gives feeble breathing over the affected area, and occasionally slight dulness or diminished resonance. With this are found coarse sonorous, and finer sibilant râles, due to congestion and swelling of the mucous membrane of the larger and smaller bronchi respectively. These signs are soon replaced by very fine moist râles, which are usually localized in one of the lower lobes behind (Fig. 86). These localized fine râles are the first distinctive sign of broncho-pneumonia. Soon a change in the respiratory murmur is heard in the affected area, becoming feebler in intensity and higher in pitch. Elsewhere in the chest there may be coarse râles, due to bronchitis of the large tubes. In such cases the areas of pneumonia are so small and so scattered as to give in themselves no additional signs, and the case may go on to recovery without presenting anything more distinctive than the signs mentioned.

(*b*) *With areas of partial consolidation.*—In the lung at this time there are small areas of consolidation, generally superficial and separated

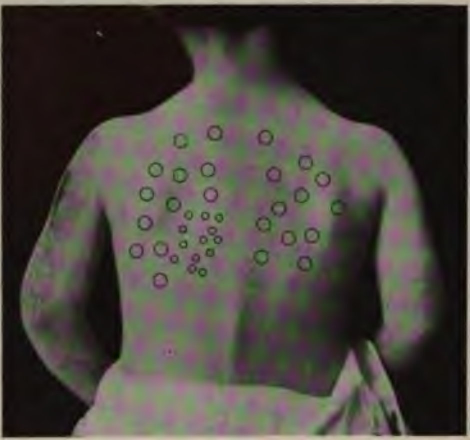

Fig. 86.—First stage. Coarse râles over both lungs; localized fine (subcrepitant) râles at the left base. No change in breathing sounds.

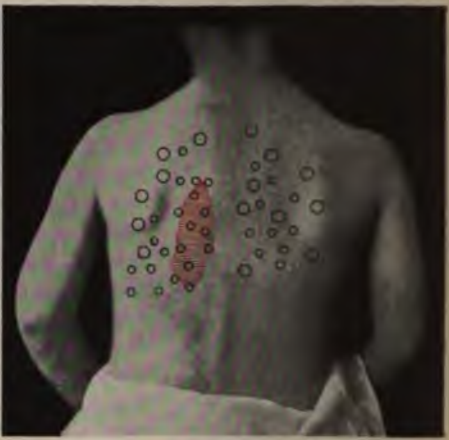

Fig. 87.—Second stage. Coarse and fine râles over both lungs behind; at left base an area of partial consolidation, with broncho-vesicular breathing, exaggerated voice, and very sharp râles.

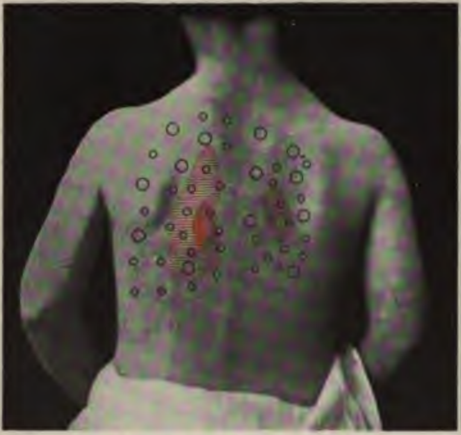

Fig. 88.—Third stage. A larger area of partial consolidation, and in the centre a small area of complete consolidation, with bronchial breathing and voice and slight dulness. Signs over the right lung similar to what were previously present over the left.

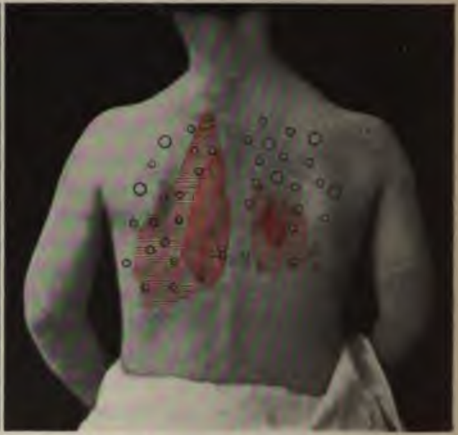

Fig. 89.—Fourth stage. Extensive disease of both sides; large area of complete consolidation on the left, with dulness, bronchial breathing and voice, and no râles; surrounding this, broncho-vesicular breathing, with many râles. Signs in the right lung similar to those previously present over the left.

Note.—The disease may stop at any one of these stages and resolution take place.

by healthy or congested lobules. Percussion in these cases usually gives negative results, but sometimes there is very slight dulness. The vocal fremitus is not usually altered. The fine moist râles may be heard over quite a large area, but at some point, usually near the spine, over one of the lower lobes, they are sharper, louder, higher pitched, and seem close under the ear (Fig. 87). Respiration is feebler here than elsewhere, and broncho-vesicular in quality, approaching bronchial breathing more and more as the consolidation increases. The resonance of the voice and cry is exaggerated.

(*c*) *With areas of consolidation more or less complete.* On percussion there is dulness, but surprisingly little in comparison with the other signs of consolidation present. It is due to the fact that the consolidated portion, though extensive, is superficial, and does not involve the lung to any great depth, and also that there are in the consolidated area many alveoli which still contain air (Plate XII). On palpation there is usually a slight increase in the vocal fremitus. On auscultation, there are still present the evidences of bronchitis, usually only behind, but sometimes over the entire chest. Coarse and fine râles are intermingled. Over the consolidated parts are heard bronchial breathing and bronchial voice. At the centre of these areas the bronchial breathing is pure and râles are usually absent, but at the margin râles are present and the breathing approaches the broncho-vesicular type (Fig. 88). The signs of consolidation thus are rarely sharply circumscribed as they are in lobar pneumonia, but shade off gradually. The consolidated area is at first small, usually in one of the lower lobes near the spine, but may gradually extend until nearly the whole of one or even both lungs behind are more or less completely solidified (Fig. 89). The signs are found as far forward as the axillary line, but usually stop here. Friction sounds may be heard over the consolidated areas, but very rarely except where signs of complete consolidation are present. It is often impossible to obtain any idea of the condition of an infant's lung during quiet, superficial respiration. Sometimes over a part which is completely consolidated there is heard only very feeble breathing, or the lung may be almost silent. If, however, the child be made to cry or to take a deep inspiration, both the bronchial breathing and râles are distinctly brought out. The intensity of the consolidation increases as the case advances, and the signs become more and more like those of lobar pneumonia. During resolution there is first a disappearance of the signs of consolidation, which may be quite rapid, but friction sounds and râles of all kinds often persist for three or four weeks longer.

The following statistics are of some interest, as showing the frequency with which signs of consolidation were found, and the day when they were discovered. Their value is increased by the fact that the children were under observation in an institution at the time they were taken sick, and that in all the fatal cases—thirty-six in number—in which signs of consolidation were absent, the diagnosis of pneumonia was confirmed by autopsy:

Consolidation noted on or before the fourth day	47 cases.
" " from the fifth to the seventh day	36 "
" " " the eighth to the twelfth day	12 "
" " after the twelfth day	9 "
No signs of consolidation	62 "
	166 "

In general, it must be borne in mind that in many cases signs of consolidation are never present, as the areas of pneumonia are small and widely scattered; that where there is consolidation it is usually incomplete, because there are small areas of healthy lung tissue between the hepatized portions; that the signs of consolidation usually shade off gradually; and that both sides are almost invariably involved, although one side usually to a greater degree than the other.

(4) *The protracted form—Persistent broncho-pneumonia.*—This is seen in primary cases, especially among delicate children, and it is not uncommon in pneumonia complicating pertussis. The onset and course of the disease for the first two or three weeks do not differ from an ordinary attack of moderate severity, but at the end of this period there is seen no tendency in the process to subside. The fever continues, but it is not high, and by physical examination it is found that the areas of consolidation are gradually increasing day by day, until sometimes the greater part of both lungs behind are involved. The air vesicles become so distended with cells that the signs of consolidation are more complete than in ordinary broncho-pneumonia. There is marked dulness, sometimes almost flatness; bronchial breathing is exaggerated in intensity, until it resembles cavernous breathing, and it may be impossible to distinguish between them. However, the fact that it is heard over so large an area, that it shades off gradually, and that it is accompanied by friction sounds, usually make a distinction possible.

The temperature in these protracted cases for the first two or three weeks is from 100° to 105° F.; but after this time it is generally lower —from 100° to 102° or 103° F. The course is not at all regular, but marked by frequent exacerbations and remissions. The general symptoms are those of progressive asthenia. There are continued wasting, anæmia, and steadily increasing prostration. The appetite is lost, often there is an aversion to food, and vomiting is easily excited if food or stimulants are forced. The stools show that even what food is taken is very imperfectly digested and assimilated. The skin becomes dry, and loses its elasticity; bed-sores may form; fine punctate hæmorrhages are seen over the abdomen, sometimes over the chest and extremities. The latter is always a very bad symptom, and I have never seen recovery where it was present.

The chart in Fig. 90 is typical of the course of one of these protracted cases terminating fatally. The temperature shows four distinct exacerbations.

Death takes place from slow asthenia, usually after five or six weeks, but the attack may be prolonged for eight or ten weeks. The general symptoms, the temperature, and the wasting strikingly resemble cases of tuberculosis, and such is the diagnosis often made.

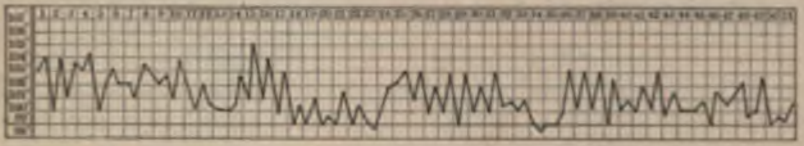

FIG. 90.—Temperature curve of persistent broncho-pneumonia, terminating fatally.

History.—Male, two and a half years old; healthy; sudden onset; for two weeks the only signs were very fine moist râles throughout both lungs, front and back. The râles in front in great part gradually cleared up; those behind persisted, but it was not until the thirty-fourth day that positive signs of consolidation were discovered in the left lower lobe behind; these signs gradually extended, and, before death, were present over nearly the whole left lung behind and over the right lower lobe. There were also friction sounds over both lungs. *Autopsy.*—Old and recent pleurisy with general adhesions; left lower lobe completely solid, patches of consolidation in left upper lobe. Right lower lobe about one half consolidated, with patches elsewhere. Bronchial glands large, but not cheesy. No evidence of tuberculosis upon either gross or microscopical examination (see Fig. 81).

Although the majority of the cases in which the fever lasts over four weeks run the fatal course just described, such apparently hopeless cases occasionally recover. The temperature gradually falls lower and lower, until it remains at the normal point. For some time after this, often two or three weeks, little change can be seen, either in the general symptoms or in the physical signs. Gradually the appetite returns, the child is brighter and begins to take an interest in its surroundings, the cough abates, and little by little the signs in the lungs clear up, and the case may go on to complete recovery. Convalescence, however, is always slow, and may be interrupted by relapses, it being many months before health is fully restored. Although the signs of consolidation disappear in a few weeks, râles are apt to persist for a much longer time. It is probable in such cases, even though all signs of disease disappear from the chest, that the lung does not become quite normal, and relapses and second attacks are always possible. The general health may be so undermined that the child never regains his former vigour; yet in a surprising number of these cases recovery seems to be complete.

5. *Secondary pneumonia.*—(*a*) Complicating pertussis.—It is not often that pneumonia develops during the first two weeks of this disease. The most frequent time is from the third to the fifth week, when the patient has become exhausted from the previous severity of the pertussis. In two thirds of my cases the development of the pneumonia was gradual, following bronchitis of the larger tubes. The temperature chart shown in Fig. 91 illustrates well this course.

When the onset is sudden, the symptoms do not differ essentially from those of primary pneumonia. The temperature of pertussis-pneumonia is usually low, in a very large number of cases not rising above 103·5° F., and ranging most of the time from 101° to 103° F. These cases are very apt to be prolonged, the fever often lasting for three or four and sometimes even for six weeks. The physical signs of consolidation may persist for a long time after the temperature has become normal, and yet the case may recover entirely. I have seen one case in which complete recovery occurred after the signs of consolidation had persisted for six months, and another in which they had persisted for over eight months. Very often the signs continue during the entire attack of pertussis. Cerebral symptoms are common, especially toward the close of the disease. Of fifty-four fatal cases twenty-five had convulsions, and in twenty-two this was the mode of death. Only one case which developed convulsions recovered.

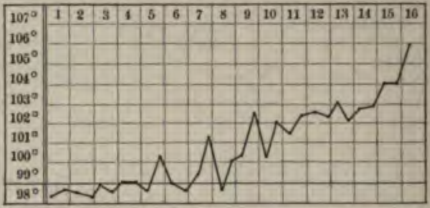

FIG. 91.—Temperature curve of fatal broncho-pneumonia, complicating pertussis.

History.—Male, six months old; delicate; pertussis for three weeks. Early signs of bronchitis of large tubes only; on the eleventh day signs of consolidation in right upper lobe. Increasing prostration, cyanosis, and death. *Autopsy.*—Large areas of consolidation in right middle and upper lobe, small scattered spots throughout left lung.

(*b*) Complicating measles.—In a small number of cases the pneumonia begins simultaneously with the invasion of measles, but generally not until the eruption appears. Instead of gradually falling to normal with the fading of the eruption, the temperature continues high. Any of the clinical types of primary pneumonia may occur in measles, the acute congestive variety which is fatal in two or three days, being especially common. In its course and duration the pneumonia of measles resembles the severe form of primary pneumonia. The broncho-pneumonia of scarlet fever differs in no way from that of measles.

(*c*) Complicating diphtheria.—In many cases this does not give a distinct clinical picture of its own, its symptoms being mingled with those of diphtheritic bronchitis, with which it is frequently associated. In others the forms resemble those seen in measles. The majority of cases occur as a complication of diphtheria of the larynx, although it is not infrequent in the septic cases in which only the upper air passages are involved. Pneumonia developing after laryngitis is usually seen within two days from the beginning of laryngeal symptoms, and runs a very rapid course. In rare cases it may develop as late as the middle or end of the second week. When it complicates diphtheritic bronchitis, pneumonia is recognised by the high temperature, rapid breathing, and increased prostration, much more certainly than by the physical signs, which are always obscured by the laryngeal sounds. Percussion may aid in the diagnosis of consolidation where the signs on auscultation are doubtful. In the early cases, death usually occurs before the disease has advanced far enough to give the physical signs of consolidation, but in the late pneumonia, which develops more slowly, these may be present.

(*d*) Complicating influenza.—Without doubt many cases regarded as primary are really secondary to influenza, particularly when that disease is prevailing, for very often the pneumonia of influenza differs in no essential points from the primary form. There are, however, two types which are quite characteristic. In the first, high temperature and prostration exist for several days before there are any physical signs of pulmonary disease, and often before there are any symptoms pointing definitely to the lungs. Pneumonia may then develop and run its usual course. The second variety are the cases of short duration often lasting but three or four days, and sometimes only two, but with excessively high temperature and very severe general symptoms.

(*e*) Complicating ileo-colitis.—This is usually a somewhat subacute form of pneumonia, which is scarcely recognisable except by the physical signs. It is seen in the protracted cases of ileo-colitis, usually of the ulcerative variety, and occurs late in its course. The temperature is not high. Cough, pain, and dyspnœa are slight or entirely wanting. Accelerated respiration is frequently the only symptom suggestive of pulmonary disease. By physical examination there are found the usual signs, generally involving both lungs posteriorly. Very often pneumonia is not suspected during life, the constitutional symptoms being sufficiently explained by the intestinal lesions, although the autopsy discloses the fact that death was due to pneumonia.

Complications.—Those relating to the lungs have been described with the lesions. Pleurisy will be separately considered. Emphysema can rarely, and abscess and gangrene never, be recognised by the physical signs.

Purulent meningitis may complicate acute broncho-pneumonia. It was met with twice in one hundred and seventy autopsies. It is in all respects similar to that occurring with lobar pneumonia. Meningeal hæmorrhage was seen only once, and was the cause of death in a patient eleven months old, who a few days before was seized with convulsions, followed by a gradually increasing stupor, which continued until death. The hæmorrhage covered the entire convexity of the brain. Endocarditis is extremely rare; it was not observed in any of my cases. Acute pericarditis was seen but twice, in both cases complicating pneumonia of the left side. Complications referable to the digestive tract are quite common. Herpetic stomatitis is frequent, and occasionally the ulcerative variety is seen. Thrush often occurs in the protracted cases among very young infants. Gastro-enteritis is not very common, considering the frequency of vomiting and diarrhœa, these depending usually upon functional derangement. In only three of my cases was there nephritis. In all it was of the acute exudative variety, and in only one case was it severe enough to affect the prognosis.

Old lesions of tuberculosis—cheesy nodules in the lungs and sometimes in the pleura—are not infrequently met with in patients dying of acute pneumonia of a non-tuberculous character.

Diagnosis.—An acute onset with continuous high fever, rapid respiration, and cough, should always lead one to suspect pneumonia. When to these symptoms are added prostration and cyanosis, the diagnosis of pneumonia is almost certain. Cases of the acute congestive type are the ones most frequently unrecognised, and in many of these cases a positive diagnosis is impossible during life. Many atypical cases of pneumonia are seen, particularly in young infants. An unusual temperature course is perhaps the symptom most likely to lead to a mistake. While this, as a rule, is high and remittent, it is sometimes not so, and may be but little above normal. Rapid respiration is almost always present, but cough may be very slight, especially in infants. In very young infants, the diagnosis often rests upon the prostration, cyanosis, and rapid respiration, the other acute inflammatory symptoms being absent. Only the physical signs of the disease can positively settle the question of diagnosis.

When pneumonia follows bronchitis of the large tubes, whether the bronchitis is primary or complicates one of the infectious diseases, the extension of the disease to the lungs is usually marked by three symptoms—a steadily rising temperature, more frequent respiration, and increasing prostration. It may be twelve or twenty-four hours before the change is indicated by the physical signs.

The diagnosis of broncho-pneumonia from congenital atelectasis has to be considered only during the first three or four months, it being rare for atelectasis to give symptoms after this time. In early infancy the danger of confusing the two is increased by the fact that atelectasis and broncho-pneumonia may be associated. If the infant has been strong and well for the first two months, congenital atelectasis can be excluded. It is likely to be found in delicate infants, where there is a history of difficulty in resuscitation at birth and feeble cry during the early days of life. The temperature is low, often subnormal, the cyanosis is out of proportion to the other symptoms, and the physical signs are doubtful or absent.

At the outset, pneumonia can not be positively diagnosticated from severe bronchitis. Such a bronchitis often begins with severe pulmonary symptoms and a temperature of 103° or 104° F.; but this high temperature is of short duration, usually falling after twenty-four or forty-eight hours to 100° or 101° F. The prostration is much less, and all the symptoms, possibly excepting the cough, less severe. The only physical signs are coarse râles, which are heard throughout the chest.

The same rules apply to bronchitis of the smaller tubes. The râles are heard both in front and behind, and usually over both sides. If with such râles the temperature continues to rise for three days in succession above 103° F., it may be assumed that pneumonia is present, provided there is no other disease which might explain the temperature. If, instead of being generalized, the signs of bronchitis are limited to a single lung, or to one lung posteriorly, the existence of broncho-pneumonia may be regarded as certain. Localized bronchitis, then, is always to be interpreted as broncho-pneumonia, provided tuberculosis can be excluded. In doubtful cases the chances largely favour broncho-pneumonia rather than bronchitis. Attention is again called to the fact already mentioned, that there are a large number of cases of pneumonia without signs of consolidation.

The differential diagnosis of broncho- from lobar pneumonia will be considered in connection with the latter disease. On account of the remittent temperature, broncho-pneumonia may be confounded with malarial fever; if with the latter there is some bronchitis, or if accompanying the onset of a severe malarial paroxysm there is pulmonary congestion—two not infrequent combinations—the difficulties are increased. A positive diagnosis is often impossible except by careful observations of the temperature for one or two days. The points of differentiation are, that the temperature of pneumonia, though often remittent, is very rarely intermittent, and that it is not affected by quinine. In addition, the characteristic features of malaria—enlargement of the spleen, the plasmodium in the blood, and a history of exposure—must, of course, be taken into account.

Both the acute and the persistent forms of simple broncho-pneumonia may be confounded with the tuberculous form; the points of distinction are considered in the chapter on Tuberculosis.

Prognosis.—Broncho-pneumonia is always a serious disease, and in an infant dangerous to life. The prognosis depends upon the age, surroundings, and previous condition of the patient, upon the nature of the infection, whether the disease is primary or secondary, and, if the latter, upon the character of the primary disease. In private practice the mortality from broncho-pneumonia is from 10 to 30 per cent, depending upon the conditions mentioned. One whose knowledge of broncho-pneumonia is derived from observations in private practice can, however, form but little idea of the frequency and severity of this disease in hospitals and asylums for infants and young children, particularly when it occurs with epidemics of measles, diphtheria, and pertussis. The statistics in the fol-

lowing table are taken fr
am connected, and fairl
dren under three years:

Forms of Pneumo
Primary broncho-pneumonia.
Following bronchitis of the la
Secondary to measles........
" " pertussis.......
" " scarlet fever....
" " diphtheria......
" " ileo-colitis......
" " epidemic influen
" " varicella.......
" " erysipelas......
Totals.................

The mortality varies
highest during the first ye
by the following table gi
cases:

Age.
During the first year..........
" " second year........
" " third year.........
" " fourth year........
" " fifth year..........

In this table are includ
or diphtheria.

Probably the best of all
fection is the temperature.
virulent type of infection.
figures, giving the highest t
and thirty-one cases, not in

Highest Temperature.
106° F. or over................
105° or 105·5°.................
104° or 104·5°.................
102° to 103·5°....... ....
99·5° to 101·5°................

The high mortality of th
to the fact that they nearly

vitality. Cases with a steadily high temperature—between 102·5° and 104° F.—usually do better than those with wide fluctuations, such as 100° to 105·5° F. The probable explanation of this is, that the former are due to the pneumococcus, while the latter are apt to be cases of mixed infection, or due to the streptococcus. As a rule, the danger of the disease increases steadily with every degree of temperature above 104·5° F.

An important factor in the prognosis is the previous condition of the patient. One of the most unfavourable is rickets, both on account of the feeble muscular power of these children and their thoracic deformities. Any condition which diminishes the general vitality increases the danger from broncho-pneumonia. As a rule, second attacks are more serious than the primary ones, especially if the interval between them is short.

In making the prognosis in any given case, the symptoms to be considered are the height and course of the temperature, the presence or absence of nervous symptoms, the condition of the organs of digestion, the presence of cyanosis and the extent of the disease as shown by the physical signs.

Nervous symptoms early in the disease do not affect the prognosis. Three cases in which convulsions occurred at the onset all recovered, but of thirty-seven cases in which convulsions occurred at a late period during the course of the disease, all but one proved fatal.

So long as the food is well taken and retained and the stools show that it is being assimilated, no case is hopeless, no matter how severe the other symptoms may be; but the existence of vomiting, diarrhœa, or severe indigestion makes the issue doubtful, even though the other symptoms are very favourable. These conditions are especially important in protracted cases, where death is usually due to slow asthenia.

Treatment.—The most important part of prophylaxis is to give careful and early attention to every attack of bronchitis in an infant, for every such attack should be regarded as a possible precursor of pneumonia. It is striking that one sees broncho-pneumonia so seldom in private practice among the better classes, even though bronchitis is very frequent; while among hospital and dispensary patients, where bronchitis is very often neglected, broncho-pneumonia is constantly seen. The question of isolating cases of pneumonia is one which is lately becoming more and more important. While it may not often be the case that primary pneumonia is due to contagion, there seems to be little doubt that this is at times true of the pneumonia secondary to measles and diphtheria. Twice in one institution have I seen regular epidemics of broncho-pneumonia occur with outbreaks of measles—in some of the wards nearly every case of measles developing pneumonia. In another institution, during one entire season (1888–'89), almost every case of diphtheria transferred to a certain isolation pavilion developed pneumonia, and died from that complication. Cases of measles and diphtheria which are complicated by pneumonia

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they are treated should
for simple cases.

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thorough airing. Nothi
acute pulmonary disease
be kept in bed. Infants
in the nurse's arms. A f
tial; no child should be
The general rules for feed
lowed here. As a rule, nei
tered in the food.

The same local treatm
(page 467). The oiled-sil
and counter-irritation ma
poultices of flaxseed may b

Emetics.—What was s
treatment of bronchitis ap
both had better be omitted

Stimulants.—Alcoholic
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tration see page 49.) The
patient. From one half to
one year. It is rarely advi
hours at a time at critical
may be used. Contrary to
lants are usually well bor
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crisis of the disease. When
generally required.

In many cases strychnin
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dose is to be repeated every

wise to give to an infant a year old. This may be kept up for days, and for a shorter time larger doses may be given, the effect always being carefully watched. For older children digitalis may be used, but I have rarely seen much benefit from it in infants. In attacks of heart failure associated with pulmonary congestion, nitroglycerin should be given—gr. $\frac{1}{500}$ every hour for four or five doses, or even longer.

Respiratory stimulants are needed in most cases, even more than are cardiac stimulants, but we have none which can be wholly depended upon. For a short time, atropine gr. $\frac{1}{800}$, caffein gr. $\frac{1}{20}$, or strychnine gr. $\frac{1}{300}$, may sustain a child with sudden failure of respiration, but in the slow respiratory failure that results from exhaustion their effect is but temporary. The doses mentioned are for an infant of one year. The drugs may be used successively or together; for immediate effect they should be given hypodermically. Oxygen may be classed with the respiratory stimulants. It should be given continuously, but always freely mixed with atmospheric air. A good method is to place the child in a half-open tent, beneath which the gas is introduced. Gentle friction of the chest wall, without disturbing the patient, is sometimes useful in stimulating the respiratory muscles, especially in protracted cases.

Antipyretics.—It must be remembered that the normal range of temperature in broncho-pneumonia is from 101° to 104·5° F. This temperature is not in itself exhausting, and the chances of recovery are not, I think, improved by systematic efforts at reducing it so long as it remains within these limits. Too much can not be said in condemnation of the practice of giving such drugs as phenacetine, antipyrine, and antifebrine in full doses for the reduction of temperature. In small doses they are often useful to allay nervous irritability, restlessness, and promote sleep. Quinine can not be considered an antipyretic in pneumonia except in cases complicated by malaria. Otherwise it does little if any good, and often great harm, by disturbing the stomach.

Antipyretic measures are indicated in cases of hyperpyrexia, which we may define as 105° F. or over, or when extreme nervous symptoms exist, even though the thermometer may not register the degree mentioned. Under these circumstances, the most certain, the most within our control, and hence the safest antipyretic, is cold. It may be used by the graduated bath, the cold pack (pages 47, 48), sponging, or an ice-bag applied to the chest.

The most convenient and efficient methods of using cold are the bath and the cold pack—the bath for infants, and the pack for older children. The peripheral circulation should be closely watched, and maintained by friction of the body during the bath, and the application of heat to the extremities immediately after it. In most cases the bath should be preceded by stimulants. The effects are often very striking; when there have been a flushed face, hot dry skin, extreme restlessness, and muscular twitchings, all these symptoms may subside rapidly and a quiet sleep follow. The bath should be repeated as soon as these symptoms return, whether the thermometer has risen to its fórmer height or not. When with hyperpyrexia we have general cyanosis, cold surface, feeble pulse, shallow respiration, and stupor, cold is contraindicated and a hot mustard bath should be used.

Inhalations.—These are of more value in relieving cough and in promoting bronchial secretion than any other means we possess. At the same time, they seem often to have a beneficial influence upon the local process. They are useful in proportion to the amount of bronchitis which is present. The same substances are to be used, and in the same way as mentioned in the article on Bronchitis.

The *nervous symptoms*, restlessness, loss of sleep, etc., are often best controlled by cold or tepid sponging; in other cases by small doses of phenacetine—i. e., one grain every two hours to a child of six months. Opium is to be avoided unless there is severe pain, which is very rare; or, when the incessant cough is not relieved by inhalations. Dover's powder is the preparation to be preferred, and an occasional dose of a quarter of a grain usually all that is necessary.

Sudden *attacks of general collapse* with cyanosis are frequent in severe cases of broncho-pneumonia. They may come on at any period in the disease. When occurring in the early stage, if promptly and energetically treated, recovery may take place, but when they come on in the late stages they are usually fatal. They may be due to acute congestion or œdema of the lung not previously involved. The most efficient treatment is to put the child into a hot mustard bath (page 54), to use strychnine and nitroglycerin hypodermically, and to give oxygen continuously. For a few hours alcohol should be given *ad libitum*. Nitrite of amyl is sometimes more efficient than nitroglycerin, because of its almost instantaneous effect. I must confess to have seen very little benefit from the use of camphor, although many excellent observers esteem it very highly.

Treatment of protracted cases.—Where the fever continues for five or six weeks, with no disposition on the part of the disease to subside, about all that can be done is to continue the sustaining treatment adopted in the earlier part of the disease—careful feeding, judicious stimulation, and proper hygienic means. Many of these cases will recover if the patient's strength holds out; but, unfortunately, in the majority the continuance of the pneumonic process is in itself evidence of the weakened vitality of the patient, and, though he may live a long time, the attack proves fatal in the end.

Where the fever has disappeared, and there is only a persistence of the physical signs and the general cachexia, the cases are more hopeful. Here, a change of air is more important than all other means of treatment. If in the winter or spring the child can be removed to a warm, dry climate where it can be kept in the open air, or if, in the summer, it can be taken to the mountains, immediate improvement is often seen, followed by rapid recovery. This experience we see repeated every year with hospital patients when they are transferred from the city to the country in May or June. With the change of air a general tonic plan of treatment should be followed, cod-liver oil, arsenic, iron, and quinine being used, according to the indications in each particular case.

In specific drugs to promote resolution I have no faith. Where the cough continues, creosote may be used both internally and by inhalation, as after bronchitis. One should never declare one of these cases of protracted pneumonia to be hopeless, nor should he be too ready to assume that tuberculosis is present because the child is wasted and anæmic, and the physical signs have persisted. In private practice the cases of simple protracted pneumonia outnumber the tuberculous ones, three to one.

Summary.—In the treatment of broncho-pneumonia it should be borne in mind that, while very little can be done for the disease, very much can be done for the patient. The hygienic measures generally grouped under the term "careful nursing" are of great importance, and many of the mild cases need no other treatment. In severe cases, the patient may be in great danger in the early stage from two causes: first, from the intensity of the general infection, which is best combatted by the use of alcohol and strychnia; and, secondly, from the mechanical embarrassment of the heart and respiration, in consequence of the sudden interference with the function of the lungs, partly from inflammation, but chiefly from congestion; this is best relieved by counter-irritation to the chest and heat to the extremities. During the later stage the principal danger is from exhaustion; this forbids the use of all depressing measures, and necessitates the most careful attention to the nutrition of the patient throughout the disease. All unnecessary medication is to be avoided, particularly the use of expectorant mixtures, on account of the disturbance of the stomach. Opium is to be used very sparingly, and in most cases it should be withheld altogether. The cough is best relieved by inhalations of creosote, and the nervous symptoms by phenacetine or baths. For local use, the oiled-silk jacket is better than poultices. Counter-irritation by mustard should be continued throughout the attack, when there is much bronchitis. Where antipyretics are required, cold is safer and more efficient than the use of drugs. Of the cardiac stimulants, alcohol and strychnia are most to be depended upon. Care should be taken in all cases to maintain a good peripheral circulation. In sudden general collapse, the most valuable measures are hot mustard baths, strychnia hypodermically, alcohol freely by the mouth, and the inhalation of oxygen. In protracted cases, and in those with delayed resolution, change of air is more important than all other means combined.

DISEASE

Synonyms: Fibrinous p

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companied by a local lesi
eral symptoms correspond
they may be out of all pro

Etiology.—*Age.*—Loba
recently seen a case in an i
cal course. It may be se
after the second year that
nearly all the cases of prim

Of 160 personal cases, a
were as follows:

AGE.
During the first year..........
From the second to the sixth ye
" " seventh to the eleven
" " twelfth to the fourtee
Totals....................

The greatest susceptibil
year, and during this period
year.

Sex.—Of my own cases,
portion was noted in 544
has been everywhere observ

Season.—In my series of

In the three winter months.. ...
" " spring " ......
" " summer " ......
" " autumn " ......
Totals....................

* For the relative frequency o
the table on p. 479.

Lobar pneumonia, in children therefore, as in adults, occurs most frequently during the spring months. April showed the largest number of any single month.

Previous condition.—In my hospital cases, 82 per cent of the children were previously in good condition, and only 18 per cent were delicate, rachitic, or syphilitic. This observation has been borne out by my experience in private practice—viz., that as a rule lobar pneumonia affects children who were previously healthy.

Previous disease.—Previous attacks of pneumonia are observed in but a small proportion of cases. It was noted only five times in 160 cases. In the vast majority of cases lobar pneumonia is a primary disease, although it occasionally occurs as a complication of pertussis, measles, typhoid or scarlet fever, and even diphtheria—chiefly, however, in children over three years old.

Epidemics of lobar pneumonia I have never witnessed, although on several occasions I have seen two children in a family attacked either simultaneously or in rapid succession. Exhaustion, fatigue, and exposure are to be ranked as associated exciting causes.

In addition to other causes, there is required for the production of the disease the presence and growth of the pneumococcus.

Lesions.—*The seat of the disease.*—In 950 cases in children under fourteen years, this was as follows:

SEAT OF DISEASE.	Personal cases.	Collected cases.	Totals.
Right lung, upper lobe only	39	137	176
" " middle " "	8	4	12
" " lower " "	26	142	168
" " more than one lobe	13	64	77
Totals, right lung	86	347	433
Left lung, upper lobe only	25	68	93
" " lower " "	49	214	263
" " more than one lobe	9	29	38
Totals, left lung	83	311	394
Both lungs, upper lobes	..	13	13
" " lower "	3	38	41
" " elsewhere	9	60	69
Totals, both lungs	12	111	123

The right lung was thus affected in 45·5 per cent; the left lung in 41·5 per cent; both lungs in 13 per cent. In the order of frequency, the disease involves, first, the left base; second, the right apex; third, the right base; fourth, the left apex. The disease affects, as a rule, a single lobe, and often only a circumscribed portion of a lobe, stopping sharply at the interlobar fissure.

Lobar pneumonia am
tunities for a study of the
limited. I have myself n
pital records reports of
anatomical changes resem
exudation into the alveoli
and red blood-cells (Fig.
flammation of the mucou
pleura. The frequency an
lesion in children.

In the first stage, that
dark-coloured, heavy, and
serous and cellular exudat
epithelial cells lining the al

In the second stage, tha
udation upon the pulmonar
it a dull, granular look. T
It is solid, and cuts like li
utmost extent and then inje
consolidated area is sharpl
cles are seen to be distend
but with some leucocytes, re
The cells are chiefly leucoc
the pneumonia of adults.

In the third stage, or *gr*
the inflammatory products
place irregularly throughout

The fourth stage, that
consists in the degeneration
tion, which are ultimately ca
into the bronchi and remove

The duration of the stage
days; that of the stage of red
weeks. This is the conditio
autopsy. The stage of gray
tion usually begins when the
it may be delayed for sever
a week.

Variations in the lesions.—
the lung may remain consol
(2.) The stage of gray hepati
of pus cells, which may ever
may be circumscribed so as t
ones. (3.) There may be sm

are very rare in children. Purulent infiltration and delayed resolution were not noted in any of my cases, and gangrene but once. (4.) There may be excessive pleurisy, or pleuro-pneumonia. This was found in one half of my autopsies. These cases will be separately considered elsewhere.

Lesions in other organs.—With pneumonia of the left side, if complicated by pleurisy, there may also be pericarditis. This was seen in two of my cases. The pericardial inflammation closely resembled that of the pleura. There was a very abundant exudation of fibrin and pus, coating both surfaces of the pericardium. Acute meningitis has been rarely observed. It was met with twice in my cases. The form of inflammation was an acute purulent meningitis, with a very abundant exudation of greenish-yellow lymph, chiefly at the convexity. In one of my cases peritonitis was also seen as a complication of pleuro-pneumonia. As the pneumococcus is found in all these inflammations, they may be regarded as examples of a more generalized infection than usually occurs. In most of these the other processes are secondary to that in the lungs, but sometimes they begin simultaneously with, or may even precede, the pulmonary lesion.

The heart is generally found in diastole, with the cavities, especially those of the right side, distended with soft clots. There may be found ante-mortem thrombi, which may extend into the pulmonary artery or the aorta.

Symptoms.—(1.) *The typical course.*—A child three or four years of age, after a few hours of slight indisposition, is suddenly taken with vomiting, followed by a rapid rise in temperature. He is dull and heavy, complains of headache and general weakness, refuses food, and is easily persuaded to remain in bed. He has the appearance of being quite ill, even after a few hours. Occasionally sharp pain in the side is complained of. The skin is dry; there are marked thirst, restlessness, and the other symptoms which accompany fever. The temperature is found to be 104° F., or even higher; the respirations 40 to 50 a minute; the pulse full, strong, and 120 to 130. On the second day the patient is no better. The temperature remains high; the tongue is coated; the anorexia continues; the pain is more severe; cough is present and may be quite frequent.

After the second or third day the patient is usually more comfortable, and sleeps better, but may be disturbed by the cough. At times there is restlessness, and at night there may even be slight delirium. The respiration continues rapid and the temperature high. These general symptoms show very little change until the sixth or seventh day, when, after a long sleep, which has been more natural than before, the patient wakes, decidedly improved as to all his symptoms. There is less fever, and the temperature continues to fall rapidly until it touches the normal line, or it may even go below this. As the fever subsides the pulse drops to 90 or 100, and the respirations to 25 or 30 a minute. The appetite soon returns,

and convalescence is usu
and in a month from the
it may be another month
covered. This is the co
lobar pneumonia at this a

(2.) *Pneumonia of sh*
course of from five to eig
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process in the lung passes
of short pneumonia, and t
duration. They are alway

(3.) *Abortive pneumon*
hospitals, but it is not infr
is summoned at the earli
that of ordinary pneumon
case. The physical exami
first stage of the disease, b
greatly surprised to find th
that all the physical signs
does not seem to go beyond
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There seems, however, to
pneumonia. D'Espine fou
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infectious diseases so frequ
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terminates in this way is n
of the patient is greater tha
is less.

(4.) *The prolonged cour*
is not rare for pneumonia
This prolonged course is o
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a single lobe. A prolonged
sibility of complications, usu
severe.

(5.) *Cerebral pneumonia.*
Barthez to cases of pneumon
nated. They will be conside

Onset.—Prodromal symptoms of more than a few hours' duration are quite rare. The onset of lobar pneumonia is almost invariably sudden, with well-marked symptoms—vomiting, diarrhœa, chill, or convulsions. Vomiting is altogether the most frequently seen. It was the mode of onset in about one half my cases. In summer particularly, there may be vomiting and diarrhœa. A distinct chill is rare in a child under five years of age, and is not very common even in older children. Convulsions are not very infrequent, being seen in about five per cent of the cases. Their occurrence depends upon the suddenness of the invasion and the susceptibility of the patient.

Cough.—This is present in most of the cases throughout the disease, but often is not marked for the first day or two. It is seldom a distressing symptom. A disposition to suppress the cough on account of pain is very frequently noticed.

Expectoration.—This is rarely seen in childhood, and practically never under five years of age. Children of ten or twelve may have the same expectoration as adults—white and viscid, or brownish-red early in the disease, yellow and abundant toward its close.

Pain.—Headache and general muscular pains in the back and extremities are frequent during the invasion. The characteristic pain, however, is pleuritic. It is not necessarily felt in the region of the affected lung, and often not in the chest at all. It is frequently referred to the loin, the epigastrium, or to any region to which the intercostal nerves are distributed. In a recent case, in a boy of seven years, for the first twelve hours there was intense localized pain in the right iliac fossa, associated with such extreme tenderness as to lead to the suspicion that the case was one of appendicitis. The pain may last throughout the disease, and occasionally it is a most distressing symptom; but usually it is only moderate, and rather more severe early than late in the disease.

Prostration.—This is one of the characteristic features of pneumonia. The patient is generally willing to go to bed on the first day of the attack, and shows little desire to leave it while the disease continues. "Walking cases" are not common in children.

Respiration.—This is always accelerated, and generally out of proportion to the pulse. The normal ratio of the respiration to the pulse is one to four; in pneumonia, frequently one to two. The respiration is not laboured and not quite panting, although this term is sometimes used to describe it. It is jerky. There is a short inspiration, then a momentary pause, followed by a quick expiration, which is accompanied by a short moan. This expiratory moan is very characteristic. The rapidity of respiration is usually in proportion to the amount of lung involved, but it is also modified by the temperature, as the respirations often drop from 60 to 30 in the course of a few hours at the crisis.

Pulse.—In the early part of the disease this is frequent, full, and strong, from 110 to 140 a minute. Later it may be weak, small, compressible, and sometimes irregular. It is relatively more rapid in the child than in the adult. The frequency of the pulse is of less importance than its character.

Temperature.—The typical temperature curve of lobar pneumonia (Fig. 92) is characterized by an abrupt rise usually to 104° or 105° F., and by daily fluctuations generally within the limits of two or three degrees until the crisis, at which time the temperature falls to normal, usually in the course of twenty-four hours. After this time it does not go above the normal line. Such a curve is seen in the majority of cases over three years of age.

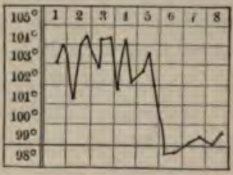

FIG. 92.—Typical temperature curve of lobar pneumonia.

History.—Male, three years old; in fair condition; sudden onset; signs of consolidation—bronchial respiration and voice, and dulness—over left lower lobe behind, not distinct until the morning of the fifth day. On the seventh day the lung was resolving.

In cases under three years of age it is not uncommon for the temperature to be of a more or less remittent type (Fig. 93).

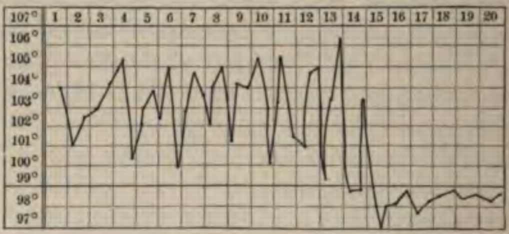

FIG. 93.—Lobar pneumonia with remittent temperature.

History.—Female, eighteen months old: in fair condition; sudden onset; repeated examinations of chest made, but no abnormal signs until the ninth day, when there were very rude respiration and slight dulness at the right apex, in front; on the twelfth day all the signs of consolidation at the same point, no râles; four days after the crisis the lungs were clear.

These wide fluctuations often lead to great difficulty in diagnosis, particularly if the physical signs appear late, as they not infrequently do. It is possible that some of them are to be explained by mixed infection.

The following chart (Fig. 94) illustrates three features which are often seen in pneumonia: (1) A temperature which early in the disease is steadily high and as the day of crisis approaches becomes remittent; (2) a secondary rise after being normal for twenty-four hours, which was due in this instance to an extension of the disease to a new part of the lung; (3) a fall to a point considerably below normal at the time of the crisis. In this case the temperature fell in the course of eighteen hours from 105° to 95° F., and later still lower; it was two days before it finally remained at the normal point. A fall to 96·5° or 97° F. at the time of crisis is not uncommon.

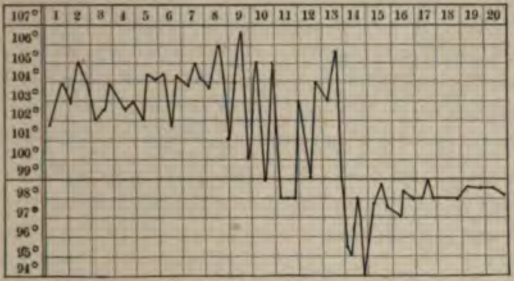

FIG. 94.—Lobar pneumonia with subnormal temperature after the crisis.

History.—Female, nineteen months old; fairly healthy; sudden onset; symptoms typical but physical signs delayed; consolidation in left mammary region on the eighth day; on the ninth in right lung middle lobe; on the eleventh day a pseudo-critical drop, followed after twenty-four hours of apyrexia by a further rise, which was accompanied by signs of extension of the disease in the right lung. Resolution rapid after crisis.

In the foregoing cases the fever terminated by crisis. In Fig. 95 is shown one ending by lysis. This is a mode of termination much more frequent in young children than in those who are older. Thus, in ninety-three of my own cases, nearly all of which were under three years of age, the fever ended by crisis in forty-nine, and by lysis in forty-four; while in five hundred and twenty-two collected cases, the majority of which were in older children, three hundred and ninety-six ended by crisis, and one hundred and twenty-six by lysis.

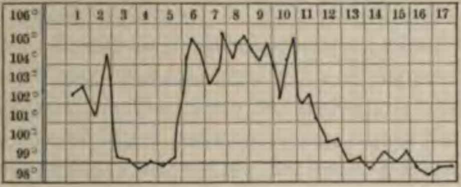

FIG. 95.—Abortive pneumonia in left lung, followed by typical pneumonia in right lung, terminating by lysis.

History.—Male, seventeen months old; healthy; sudden onset; on the second day disseminated fine râles in both lungs behind, and over left lower very feeble respiration, high-pitched—i. e., some bronchitis, with congestion (?) of left base. On the third, fourth, and fifth days, general symptoms gone and signs nearly disappeared. On the sixth day all symptoms of pneumonia, and on the seventh distinct consolidation of right base, rest of chest clear. Subsequent course typical; resolution rapid and complete.

The following table sh
seven cases of lobar pneum

Second day
Third "
Fourth "
Fifth "
Sixth "
Seventh "
Eighth "
Ninth "
Tenth "

From this table it will
the seventh, and that in 66
the eighth day. The cause
chiefly two—extension of t
of pleurisy, which is apt t
meningitis, pericarditis, ga
temperature is generally hi
that the temperature is co
in the majority of cases it
102° to 105° F. In fifteen
per cent, it reached 106° F.

Gastro-enteric symptoms.
older children. At the on
also diarrhœa. A continua
due to improper feeding or
plication. Diarrhœa is also
It is sometimes seen at the ti
are anorexia, coated tongue,

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convulsions are not generally followed by an especially severe type of the disease, only one of seven cases beginning in this way proving fatal. On the other hand, late convulsions are usually fatal. In two of the three cases in which I have noted them, the convulsions ushered in an attack of meningitis.

Delirium is much more frequent than convulsions, and is seen in nearly one fourth of the cases. Generally it is slight, and noticed only at night or when the temperature is very high. It is usually mild, but may be low and muttering, like that of typhoid, or wild and active, like that of cerebro-spinal meningitis. It is most pronounced at the height of the disease. Other nervous symptoms belonging to the typhoid state, such as incontinence of urine or fæces, muscular twitchings, and tremor of the tongue on protrusion, are occasionally seen, but only in the worst forms of the disease.

There is no relation between the seat of the disease in the lungs and the occurrence of cerebral symptoms. They are more frequent in children under five years than in those who are older, and depend upon the suddenness of the invasion, the intensity of the infection, and the susceptibility of the child. Late in the disease they may indicate exhaustion, toxæmia, or complicating meningitis. They are frequently associated with very high temperature and extensive disease.* The usual nervous symptoms—restlessness, headache, sleeplessness, etc.—are nearly always proportionate to the height of the temperature.

Urine.—Throughout the febrile period of the disease the urine is scanty, high-coloured, with a high specific gravity, and usually loaded with urates. In a small number of cases a trace of albumin may be found, and occasionally a few hyaline casts. Evidences of serious renal disease I have seldom found in lobar pneumonia, and in the experience of all observers it is extremely rare in early life.

Skin.—The face, in pneumonia, is usually flushed, sometimes on both sides and sometimes only on one; in other cases it is pale, but not indicative of pain. Cyanosis is rare except toward the close of the disease and is usually a sign of respiratory failure. Herpes of the lips or face is quite frequent.

Physical Signs.—The earliest signs in pneumonia are due to the acute congestion of the affected lung or lobe, in consequence of which less air enters this portion and more air the rest of the lungs. Percussion gives diminished resonance or slight dulness over the affected area, and exaggerated resonance over the remainder of this lung and over the opposite lung. Auscultation over the affected lobe gives feeble respiratory murmur, rather high in pitch; sometimes there may be absence of all breath-sounds so complete as to suggest fluid. The normal respiratory murmur over the healthy portions of the lungs is intensified. In children this exaggerated breathing is not infrequently mistaken for bronchial breathing, and the physician may be led into the error of locating the pneumonia upon the wrong side. Exaggerated breathing does not differ from normal breathing except in intensity, and is heard only on inspiration. Bronchial breathing is higher in pitch, and is heard with nearly equal intensity both on expiration and inspiration. If the chest is frequently auscultated, crepitant râles (Figs. 96 and 97) may usually be heard at some period at the end of full inspiration, but often they are present but for a few hours, and they may be missed altogether.

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* For a fuller discussion of the cerebral symptoms of pneumonia, see a paper by the author, in the New York Medical Record, April 7, 1888.

In the second stage, that of consolidation (Fig. 98), no air enters the affected part of the lung. Upon palpation there is found here exaggerated vocal fremitus, and on percussion there is marked dulness, but very rarely flatness. Over the rest of this lung there is exaggerated, sometimes even tympanitic, resonance; this is especially frequent at the apex of the lung in front, when there is consolidation at the base behind. Under these conditions cracked-pot resonance may sometimes be obtained. Over the healthy lung there is exaggerated resonance. On auscultation over the consolidated portion there are bronchial breathing and bronchial voice, the area over which they are heard being sharply defined. Râles are usually absent, but there may be pleuritic friction sounds.

In the stage of resolution there is a gradual disappearance of the signs of consolidation. The pure bronchial is replaced by broncho-vesicular breathing, the vesicular element gradually predominating. Moist râles of all varieties are heard. Usually the most persistent signs are slight dulness or diminished resonance, with a respiratory murmur which is feebler than normal and a little higher in pitch; sometimes there are also dry friction sounds. These signs may persist for two or three weeks.

Exceptional physical signs.—While in the majority of cases the signs of consolidation are distinct on or before the fourth day, in not a few they may be delayed much longer. Of eighty-two cases in which the day was noted on which consolidation was found, it was not until the fifth day or later in one fourth the number. In six of them, although carefully and repeatedly examined, no consolidation was found until the seventh day or later and in one case not until the twelfth day. It has been customary to look upon these cases of delayed or concealed physical signs as cases of central pneumonia. That pneumonia may exist in the centre of a lung for a number of days is, to my mind, extremely improbable. At autopsy, superficial pneumonia I have very frequently seen, but central pneumonia never. There are two regions in which pneumonia may exist and yet not be accessible by our means of physical examination, viz., at the apex of the lung in the part covered by the shoulder, and along the posterior border of the lung where it lies against the vertebræ. In either

PHYSICAL SIGNS OF LOBAR PNEUMONIA.

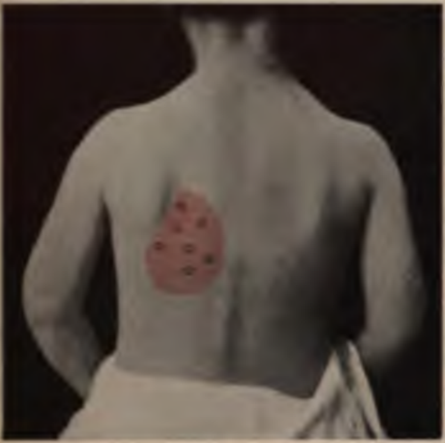

FIG. 96.—First stage. Congestion of left lower lobe, with crepitant râles. Feeble breathing of a rude character, with slight dulness.

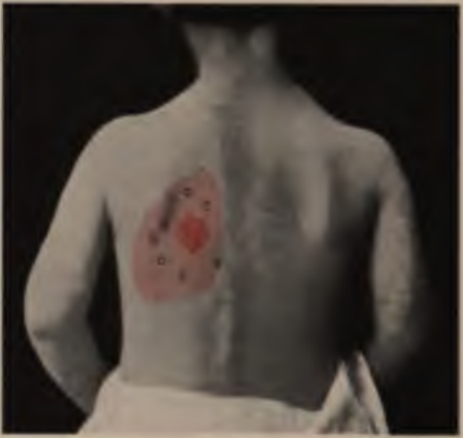

FIG. 97.—In the centre of the area, a small spot of pure bronchial breathing and voice; surrounding this an occasional crepitant râle, with broncho-vesicular breathing and slight dulness.

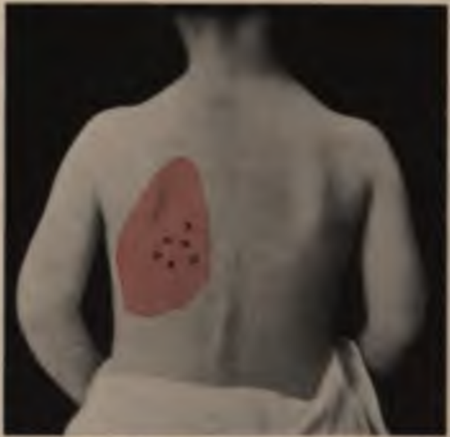

FIG. 98.—Second stage. Complete consolidation of left lower lobe. Pure bronchial breathing and bronchial voice; marked dulness; increased vocal fremitus, and at the lower part a few friction sounds.

NOTE.—During resolution the signs take the inverse order: those of Fig. 98 give place to those of Fig. 97, and these in turn to those of Fig. 96. In addition, many coarse râles may be heard.

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Death may result early in the disease, where the pneumonia has spread rapidly, involving both lungs. The earliest deaths I have seen were on the fourth day, and were due to a failure of the heart and respiration. In most of the uncomplicated fatal cases, death results from heart failure at about the time of the crisis. In the complicated cases death usually occurs in the second week. I once knew fatal meningitis to develop at the end of the fourth week.

Diagnosis.—The most characteristic differences between broncho- and lobar pneumonia are shown in the following table:

BRONCHO-PNEUMONIA.	LOBAR PNEUMONIA.
1. More than half the cases secondary.	1. Almost always primary.
2. Under three, chiefly under two years.	2. Most common between three and eight years.
3. Occurs more frequently in delicate and debilitated children.	3. More often in those previously healthy.
4. Bacteria—in primary cases, usually the pneumococcus; in secondary cases, chiefly the streptococcus, but usually mixed infection.	4. The pneumococcus.
5. Products of inflammation chiefly cellular; process often diffuse.	5. Chiefly fibrin; process circumscribed.
6. Onset often gradual, sometimes insidious, especially when secondary.	6. Onset sudden, with well-marked symptoms.
7. No typical course; fever often lasts three or four weeks; rarely terminates by crisis.	7. Typical course; crisis usually from fifth to eighth day.
8. Involves both lungs as a rule, most frequently lower lobes posteriorly.	8. Usually one lobe or a part of a lobe; left base most frequently, right apex next.
9. Signs of bronchitis mingled with those of consolidation; râles in other parts of the same lung, or in the opposite lung, throughout the disease.	9. Râles only early, and during resolution; frequently no signs in opposite lung.
10. Consolidation later—fourth to seventh day; there may be none; apt to be incomplete; shades off gradually.	10. Consolidation earlier; second or third day. Consolidation complete; area usually sharply defined.
11. Resolution slow, one week to two months; often incomplete; strong tendency to become chronic.	11. Resolution rapid, usually complete within a week.
12. Relapses and second attacks frequent.	12. Both are rare.
13. Sequelæ: Empyema, chronic interstitial pneumonia, sometimes tuberculosis.	13. No sequelæ except empyema.
14. Prognosis always serious from the age and the circumstances under which disease occurs.	14. Prognosis good; rarely fatal except from complications—empyema, meningitis, pericarditis.
15. Hospital mortality 50 per cent of primary cases, 65 per cent of all cases.	15. Mortality 4 per cent of all cases.

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are as a rule most marked during the first twenty-four or forty-eight hours, and then gradually diminish, always subsiding completely at the crisis. While most of the individual symptoms belonging to meningitis may be present, they are usually less severe and less persistent in pneumonia.

The question sometimes arises, in a case of pneumonia, whether the cerebral symptoms are functional, or whether meningitis also exists. If the nervous symptoms are present from the beginning, there is probably no meningitis. If they develop suddenly during the course or toward the close of the disease, meningitis should be suspected.

Lobar pneumonia is to be differentiated from a pleuritic effusion. The most common mistake which I have seen made is to confound empyema with unresolved pneumonia. The latter is very infrequent, so that the probabilities are always strongly in favour of the diagnosis of empyema. In pneumonia rarely, if ever, is the whole lung affected. There are increased vocal fremitus, dulness, bronchial voice and breathing, and occasionally râles or friction sounds. In empyema the whole lung is often affected, there are displacement of the heart, flatness on percussion, diminished or absent vocal fremitus, and although bronchial voice and breathing are present, they are usually distant and feeble. There are no râles or friction sounds. In doubtful cases an exploratory puncture should always be made. Serous effusions are rare, but are differentiated by the same signs as empyema.

Prognosis.—There is probably no disease in which the patient appears so ill, and where there is really so little danger to life, as in lobar pneumonia in a child over three years old. Of 1,295 collected cases, chiefly from hospital practice, there were but 39 deaths, a mortality of three per cent. In 187 cases of my own there were 21 deaths, a mortality of eleven per cent. Only one of the fatal cases was over two years old. The difference between the mortality among my cases and the general mortality given, is due to the fact that a large proportion of the first group were observed in children under two years, while of the collected cases the vast majority were in older children. Combining the above figures, we have a total of 1,482 cases with 60 deaths, a mortality of four per cent. In nearly all my cases death was due either to complications or to very extensive disease, as when both lungs were involved, or nearly the whole of one lung. In only one case was an uncomplicated pneumonia of a single lobe fatal.

The prognosis depends upon the age of the patient, the presence or absence of complications, and the extent of the disease. These factors are to be taken into consideration rather than any special symptoms. Early convulsions do not materially affect the prognosis. Of seven such cases only one was fatal. Late convulsions are always very unfavourable, indicating either exhaustion, toxæmia, or the development of meningitis.

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tepid water is better than drugs. Severe nervous symptoms, such as delirium, stupor, great restlessness with impending convulsions, when associated with high temperature, call for ice to the head, cold sponging, or the cold pack or bath. Pain, if moderate, may be relieved by counter-irritation by a mustard paste or by a hot poultice; if severe, morphine must be used in addition. The cough is rarely severe enough to require treatment. When it is so severe as to prevent sleep, small doses of Dover's powder or codeia should be given. Antipyretic measures are not necessarily called for if the temperature is high. This not infrequently continues for a few hours while the patient may be quiet and appear perfectly comfortable. Under such conditions the temperature should be closely watched, but not necessarily interfered with unless other symptoms develop. The nervous symptoms are a better guide than the thermometer to the use of antipyretics. When they exist, even with a moderate elevation of temperature, interference is indicated. Cold I believe to be the safest and most certain antipyretic we possess. It may be given as a cold sponge bath or the cold pack (pages 47, 48). There is no objection to the bath except the prejudice of the laity. While cold is applied to the trunk the extremities should be closely watched, and heat applied if necessary. The duration of the pack or bath, and the frequency of their use, will depend upon the individual case. Stimulants are not required in the majority of cases. They are called for when the pulse is weak, compressible, and rapid, when the face is pale and the extremities are cold. The same stimulants are to be employed, and in the same way, as in broncho-pneumonia (page 510). Cardiac stimulants are usually required in larger quantity at the time of and just after the crisis. Respiratory stimulants are indicated as in broncho-pneumonia.

PLEURO-PNEUMONIA.

Under this term are included cases of pneumonia with an excessive amount of pleurisy, the two processes uniting to produce a single clinical type of disease.

In nearly all cases of lobar pneumonia there is a certain amount of inflammation of the pulmonary pleura, and also in those cases of broncho-pneumonia which are accompanied by any marked degree of consolidation. In both of these the pleurisy is usually co-extensive with the consolidation. But in certain cases, in both forms of pneumonia, the amount of pleurisy is excessive, and this so modifies the symptoms and course of the disease as to require for them a separate consideration. In some it appears that the inflammatory process begins almost simultaneously in the lung and in the pleura; while in others the pleurisy follows the pneumonia. These cases are, I believe, almost invariably due to the pneumococcus, although in some there is a mixed infection.

In 398 hospital cases of pneumonia there were 27, or 6·8 per cent, which could be classed as pleuro-pneumonia, the diagnosis being confirmed either by autopsy or operation. Of 190 fatal cases, 12·5 per cent were pleuro-pneumonia. Most of these hospital patients were under three years of age, and the disease is, I think, more frequent at this period than in older children.

Lesions.—Of these 27 cases, 17 were classed as broncho-pneumonia and 10 as lobar pneumonia. The left lung was more frequently affected than the right in the proportion of three to two. In most of the cases the pleura covering the entire lung was involved, even though the pneumonia affected but a single lobe, or only a part of a lobe. In nearly half the cases both lungs were involved, but one to a very much less extent than the other. In a small number of cases the pleurisy was limited to the posterior surface of the lung, stopping at the axillary line.

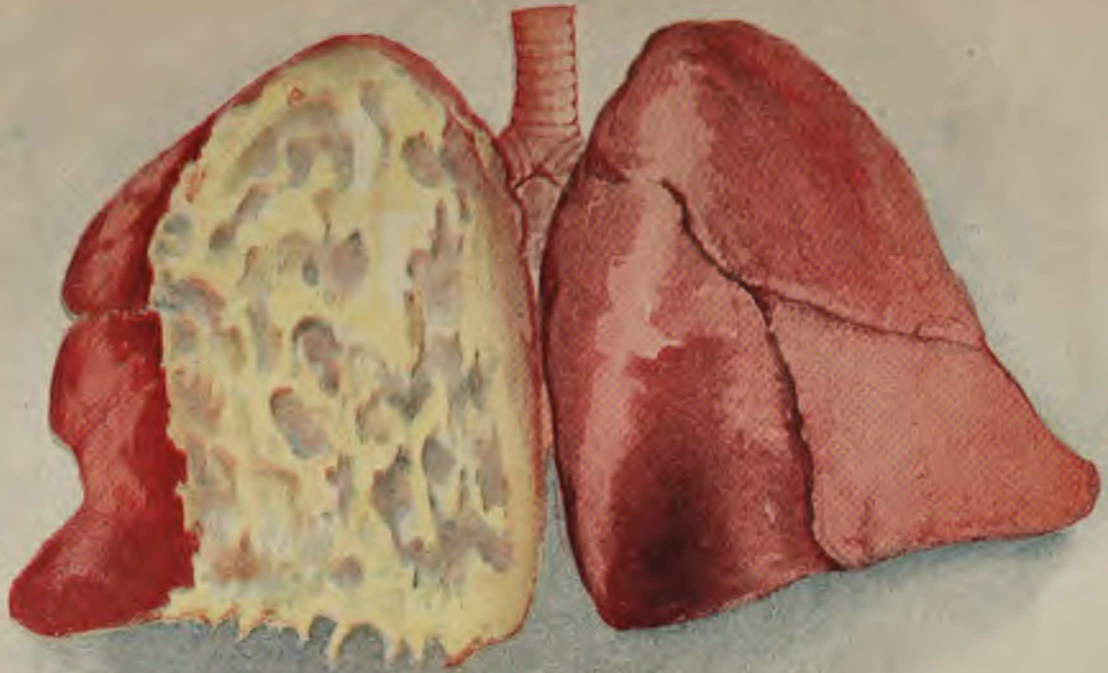
In pleuro-pneumonia both the visceral and the parietal pleura are coated with a layer of yellowish-green fibrin, in thick, shaggy masses, by which the lung is adherent to the chest wall, the diaphragm, and the pericardium (Plate XIII). The exudation varies between one eighth and one half an inch in thickness. It can often be stripped from the lung or scraped from the chest wall by the handful. In its meshes small pockets may form, which contain only a few drops, or sometimes a drachm of pus, or less frequently serum. This is the condition in which the lung is usually found where death has occurred at the height of the disease. If the process has lasted longer, larger collections of pus may be present. The lung itself shows the usual changes of pneumonia, and if there has been any considerable accumulation of fluid, there are in addition the evidences of compression.

With pleuro-pneumonia of the left side, the pericardium is occasionally involved. This was seen in two of my cases, the lesions closely resembling those of the pleura. In two cases there was also meningitis, and in one peritonitis, the exudation in all cases having the same characteristics.

An inflammation of the intensity described is very often fatal in the acute stage, if the patient is a child under two years old. Occasionally at this age, and very frequently in older children, we see the later stages of the process. The most frequent course is for more and more pus to be poured out from the inflamed pleura until the chest is filled, the case becoming thus one of empyema. Sometimes the fluid is serous instead of purulent, but this is very rare in infancy. Under other circumstances the exudation is partly absorbed, but the greater part becomes organized so as to form a thick jacket of fibrous tissue which binds the lobe or lung to the chest wall, and interferes seriously with its subsequent full expansion. Chronic interstitial pneumonia may follow.

Symptoms.—There is little which distinguishes a case of pleuro-pneumonia except the severity of all the constitutional symptoms; the tem-

TE XIII.



Acute Pleuro-Pneumonia.

The lungs have been separated in front and spread out to show the whole external surface as seen from behind. The left lung, with the exception of a narrow strip along its anterior border, is completely covered with a thick, ragged exudation of fibrin. The left lower lobe was hepatized; the right lower lobe deeply congested.

From a child one year old, who died in the New York Infant Asylum.

perature is often higher, the prostration greater, and the patient in every way impresses one as being more seriously ill than with ordinary pneumonia. Sometimes the thoracic pain is more severe and more constant than is usual in pneumonia. The diagnosis, however, is to be made by the physical signs.

In the early stage the pleuritic friction sounds are unusually prominent; after two or three days the signs of consolidation come out clearly in most cases, but still accompanied by loud friction sounds. After the fibrinous exudation is very abundant, the signs are often obscure and confusing, and there may be at no time well-defined signs of consolidation. There is usually a mingling of the signs of consolidation with those of effusion. There is marked dulness, and sometimes flatness. The vocal fremitus is apt to be diminished, and it may be absent. Bronchial voice and breathing are heard, but they are not distinct as in consolidation; they are, however, feeble and distant, as over fluid. There are usually coarse, moist, crackling pleuritic sounds, but these may be absent. The signs may be found over one entire lung, or they may be limited to the posterior region, and even to a single lobe. They resemble those present over fluid, with one exception—viz., the heart is not displaced. If an exploratory puncture is made, nothing is found; occasionally the exploring needle happens to strike one of the small pockets of pus in the meshes of the fibrin, and a few drops of clear pus are withdrawn. If an incision is made under the supposition that the case is one of empyema, no more pus may be found, the surgeon coming upon the pulmonary adhesions as soon as the chest is opened. There is scarcely any condition in the chest giving signs more puzzling than those just enumerated. They are, however, easily explained by the pathological conditions.

Prognosis.—The prognosis in pleuro-pneumonia is much worse than in simple pneumonia. In infants the outlook is very bad, the majority of cases dying during the acute stage, usually in the second week. Very young children may be overwhelmed with the extent and the intensity of the inflammation, and die in four or five days. In children over two years old the most frequent result is for the case to go on to empyema, which with proper treatment usually terminates in recovery. Where there is organization of the fibrin with the production of extensive adhesions, the ultimate result is often not so favourable as when empyema develops. Convalescence is usually slow, and the patients are liable to exacerbations of pleurisy; they may suffer for years from the partial crippling of one lung.

Diagnosis.—This is to be made only by the physical signs. A differential diagnosis from fluid in the chest can in some cases be made only by an exploratory puncture.

Treatment.—Cases of pleuro-pneumonia require no special treatment. In general they are to be managed like the ordinary cases of pneumonia

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CHRONIC BRONCHO-PN
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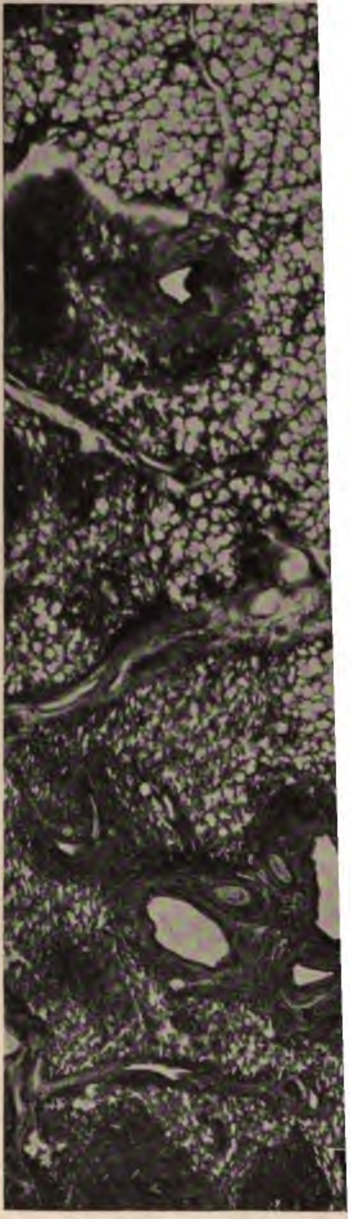
PLATE XIV.



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frequent condition apart from tuberculosis. The non-tuberculous cases, as a rule, are preceded by an attack of acute broncho-pneumonia, sometimes by several such attacks, separated by longer or shorter intervals.

Lesions.—The part of the lung affected may be an entire lobe, but usually it is a portion of one lobe, or there are areas in more than one lobe. There are dense connective-tissue adhesions binding the diseased part to the chest wall, to the diaphragm and to the pericardium, often so firmly that the lung is torn on removal. The affected lung is smaller than in health; it is hard, tough, and fibrous. Surrounding the fibrous portions are emphysematous areas. On section, the process is seen to be somewhat irregularly distributed through the lung, the lesion being usually most marked in the vicinity of the smaller bronchi, and sometimes seen only there, the intervening lung being nearly normal (Plate XIV). In some portions, where the process is most advanced, almost all trace of lung tissue has disappeared, the part resembling a solid fibrous tumour, through which run the bronchial tubes, usually much dilated. In places this dilatation may be sufficient to form cavities of considerable size. The bronchial glands are often enlarged to the size of a hazelnut, and they may be tuberculous.

Upon examination with the microscope, the pleura is found greatly thickened, with bands of new fibrous tissue passing from it into the lung. The walls of the small bronchi are generally thickened, but in some places they have undergone cylindrical dilatation, and are filled with pus. The walls of the alveoli are greatly thickened from the proliferation of the connective-tissue elements, and the alveoli are filled with organized inflammatory products, so that they are nearly or quite obliterated. The stroma is greatly increased in amount throughout the affected lung.

Symptoms.—In most of the cases there is a history of an attack of acute broncho-pneumonia, from which the child made a slow convalescence, remaining pale, anæmic, and sometimes wasted for several months. Improvement then takes place in the general symptoms, the appetite and strength return, and in many cases the lost weight is nearly or quite regained. However, neither the pulmonary symptoms nor the physical signs entirely disappear. There remains a dry, hard cough, which at times is severe. Pains in the chest are occasionally complained of, and perhaps shortness of breath on exertion is noticed. Examination shows a persistence of the dulness on percussion, with a rude or broncho-vesicular respiratory murmur of very feeble intensity. Little change may take place in these signs for months; then an acute attack of bronchitis or broncho-pneumonia may occur. If the latter, the same lung is affected, and a fresh consolidation is added to the previous disease. This attack may not be very severe, but it drags on for several weeks, with slight fever and little or no change in the physical signs. Partial resolution may then take

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simple and the tuberculous cas

majority impossible. Repeatedly have I seen a process proved at autopsy to be simple, which all who had observed the case had unhesitatingly pronounced to be tuberculous, and quite as often the opposite has been true. If the family history is good, if the patient lives in the country, if his symptoms began with a well-defined acute attack of pneumonia, if the seat of disease is the base of one lung, and if the examination of the sputum is negative, the process is probably simple. If the family history is doubtful or is positively tuberculous, if the patient lives in the city, and especially if he is an inmate of an institution or if his home is among the tenements, if the initial symptoms were indefinite, if the seat of disease is the axilla, the mammary region, or the apex in front, the process is probably tuberculous. The discovery of tubercle bacilli in the sputum is, of course, conclusive. Even the course of the disease may not settle the diagnosis, unless there develop in the bones or in other viscera, lesions undoubtedly tuberculous.

Treatment.—Nothing has any essential influence upon the disease except change of climate. This should be the same as for tuberculous cases. The treatment of the patient has for its object the maintenance of the general nutrition at its highest point, by careful feeding, judicious exercise, and by most of the measures enumerated in the chapter on Malnutrition. Cod-liver oil should be given throughout every winter season. The cough may be treated as in cases of chronic bronchitis.

GANGRENE OF THE LUNG.

Pulmonary gangrene is quite rare in children, although it is probably more common than in adults. It is most frequently associated with pneumonia. It is usually circumscribed, and in the majority of cases it is latent.

Etiology.—Children of all ages may be affected; all of my own cases have been under three years old, the youngest being an infant of four months. It occurs for the most part in children who are ill-conditioned, feeble, or cachectic, and often follows one of the infectious diseases, particularly measles. In such cases it may be associated with gangrene of the mouth or of the vulva. It is seen in general pyæmia, and has followed caries of the petrous bone. Of the local causes, altogether the most frequent is broncho-pneumonia. Of nine cases which have come under my personal observation, six complicated acute broncho-pneumonia and one lobar pneumonia. It has been present in three per cent of my autopsies upon cases of pneumonia. It may accompany pulmonary tuberculosis, bronchiectasis, and pulmonary apoplexy, or it may be due to a foreign body in one of the bronchi. The immediate cause of the necrotic process is interference with the circulation in a part of the lung, which is usually due to thrombosis or embolism of some of the branches of the pulmonary artery. To this there is added the entrance of putrefactive bacteria. In some cases the infection originating in som

Lesions.—According to frequently affected than the The surface of the lung, ra involved.

Two forms of gangrene whole lobe, or even a whol occurs in a number of smal two inches in diameter. Th In the diffuse form the lun and emits a gangrenous odo ring in pneumonia, the parts wedge-shaped, with the base they are not softened, and conditions may be present, found in a cavity with ragge dissection will reveal, in ma sels leading to the gangreno very rarely seen. However, coughed up and the cavity cl happen where there is but presence of a foreign body. place, and empyema or pneu

Two unique cases of nec they were in all respects simi form dark reddish-brown, and a large part of the lower lobe consistency, the pulmonary tis could be washed away with a odour. No thrombosis was f their origin was discovered eve some broncho-pneumonia pre ering from marasmus. These diffuse gangrene, although th usually seen.

Symptoms.—There are bu gangrene: the gangrenous odo masses of necrotic lung tissue. monia, which include the ma takes place before there is any very active decomposition in peculiar symptoms are therefo at the autopsy. This has be under my own observation. But these patients, with one exception, were infants. In older children, particularly in cases secondary to the entrance of a foreign body, the characteristic symptoms are more frequently seen, and there may be a third symptom—hæmorrhage. This is present in about one fourth of the cases (Rilliet and Barthez), and may be fatal. The general symptoms associated with gangrene are those of profound depression, and often all the signs of the typhoid condition are present.

From what has already been said, it will be evident that the diagnosis is very difficult in children, and that most cases of gangrene of the lung are overlooked. When the characteristic odour of the breath is present, conditions in the mouth from which it might arise must first be excluded. The physical signs differ in no respect from those of ordinary cases of pneumonia. The termination is almost always in death. This is due not only to the condition itself, but to the circumstances in which it is seen.

Treatment.—The general treatment is supporting and stimulating, as in all very severe cases of pneumonia. For the local process but little can be done, except the inhalation of antiseptics, of which creosote and turpentine are undoubtedly the best.

ACQUIRED ATELECTASIS—PULMONARY COLLAPSE.

These terms are applied to a state of the lung resembling the fœtal condition, but which occurs in a lung which has once been expanded. Two varieties are met with: collapse from compression and collapse from obstruction.

Collapse from Compression.—The principal cause of this form is pleuritic effusion. It may also be produced by pneumothorax, enlargement of the heart, pericardial effusion, deformities of the chest from rickets or Pott's disease, and tumours of the mediastinum or thoracic wall. In these conditions, on account of the external pressure, the air vesicles are not filled, although the bronchi are pervious. The elasticity of the vesicles tends to expel the air which they contain. This form of collapse may be complete or partial, according to the cause. After it has existed for a considerable time, changes may take place in the lung which render expansion difficult or impossible. Unless, however, there are thick pleuritic adhesions, expansion often takes place readily after many weeks and even months, as in most cases it is the condition of the pleura, rather than of the lung itself, which interferes with it. In recent cases only moderate force is required at autopsy to produce expansion; in old cases it is more difficult and may be impossible. The symptoms and signs are those of the original disease.

Treatment is available chiefly in that form which follows pleuritic effusion, and will be considered in the chapter on Empyema.

Collapse from Obstructio either the large or small b The importance of collapse eases of the lung in infanc It is well known that when obstructed by a foreign body portion of the lung to which collapsed. If it is one of the lung may be collapsed; if c one of the smaller divisions, The collapse does not take p vesicles are gradually absorb four hours, or even longer. absorbed, then the carbon dio portion of the lung is smaller is slightly depressed below th vascular, and to the naked may subsequently become.

It has been the fashion the development of broncho- tubes, through the interven assumed that the obstruction their walls and the accumul sult as the plugging of a bro into a full discussion of the s observations upon nearly one are included a very large nu all varieties, I have found ve bronchitis of the smaller tub to such a degree as entirely t dition of stenosis results, as not atelectasis. Such, at le in which I have had an o liest stage of broncho-pneumo alized bronchitis of the fine t very often groups of collapsed are the seat of pneumonia, but important part of the lesion. large part of the lung, or eve pertussis or in acute bronchiti way mentioned.

There is occasionally seen, u who are markedly rachitic, a gradually. It is accompanied dependent part of the lung. Its seat is the lower lobes posteriorly, sometimes also the posterior border of the upper lobes. In general appearance it may resemble the congenital form of atelectasis. Under the microscope there is almost invariably found accompanying the collapse, lobular pneumonia and bronchitis of the tubes in the affected regions.

The symptoms are much the same as in persistent congenital atelectasis. In marked cases the respiration is rapid, and there may be inspiratory dyspnœa with deep recession of the chest walls, especially if there is rickets. There is also cyanosis of variable intensity, which may be constant or intermittent. There are usually present a short cough, feeble cry, and poor circulation with cold extremities. The temperature is not elevated, but frequently is subnormal. The physical signs are very uncertain. There may be slight dulness and very feeble respiratory murmur over the affected areas, occasionally accompanied by moist râles. The course and termination are the same as those seen in some of the cases of congenital atelectasis. The essential point of difference is, that in the acquired cases the patients are often strong at birth, crying and breathing well, giving no signs of anything wrong in the lungs until the general nutrition has suffered from some other cause. The symptoms come on gradually.

The following is a fairly typical case: A female infant thirteen months old had been under observation in the Nursery and Child's Hospital for several months before death. During this period she suffered a great part of the time from mild bronchitis. The child was extremely rachitic, and the chest showed deep lateral furrows. The respiration was always accelerated, and on inspiration the lateral recession of the chest was at times extreme. There was occasionally seen slight cyanosis, and during the last few weeks it was constant. Death occurred quite suddenly. At autopsy there was found very marked vesicular emphysema of both lungs in front. Nearly the whole of both lower lobes were in a condition of collapse, and of a uniform grayish-purple colour. The posterior portion of the upper lobes was similarly affected, but to a less degree. With moderate force all of the collapsed areas could be completely inflated. Bronchitis was present, but the pleura was normal.

The treatment of these cases is the same as that outlined in the chapter upon Congenital Atelectasis (page 75).

EMPHYSEMA.

Pulmonary emphysema consists primarily in overdistention of the air vesicles. It may result in their rupture and the escape of air into the interlobular connective tissue of the lung. In infancy and childhood emphysema is usually associated with acute processes.

Etiology.—Cases of emphysema are divided into two groups which are due to quite different causes. In one group it is compensatory, and consists

in overdistention of the air
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solidated, as in pneumonia
from old pleurisy, or subje
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able that the emphysema is
produced by the artificial inf

In the second group of c
expiratory dyspnœa or cough
in acute bronchitis and br
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tion and holding the breat
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group of cases air enters the
vesicles are distended, someti
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Lesions.—The most com
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structural changes, there bei
only (Fig. 77). Although the
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pale, sometimes almost white.
lapse upon opening the chest.
the individual air vesicles ca
bodies, at times resembling
secondary to acute bronchitis
whole of both lungs.

With a greater distending
results, and this may give rise
At times blebs are formed, va
These are usually seen at the a
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nearly one fourth of an inch w
tussis. On two or three occasi
once to an extreme degree, wh
nected with the respiratory tra

which threw any light upon the etiology of the emphysema. Rupture of the blebs which form at the root of the lung may lead to emphysema of the mediastinum, or even of the subcutaneous connective tissue of the body. This is occasionally seen in whooping-cough and in laryngeal stenosis. The primary or substantive form of emphysema seen in adult life rarely if ever occurs in childhood.

Symptoms.—Emphysema occurring in acute pulmonary diseases gives rise to no peculiar symptoms and to no physical signs except exaggerated resonance upon percussion. If the patients recover from the original disease, the emphysema undoubtedly disappears completely in the course of a few weeks or months. Acute interlobular emphysema can not be diagnosticated during life. The lesion is of such a nature that complete recovery is impossible, although improvement often takes place.

The treatment of emphysema is that of the original disease.

CHAPTER VI.

PLEURISY.

ALL the common forms of inflammation of the pleura are seen in childhood. In the great majority of cases they are secondary to disease of the lung itself. Serous effusions are much less frequent than in adults, and under three years they are extremely rare. Purulent effusion (empyema) is, however, much more often seen than in adult life, and it is the most important variety of pleurisy with which the physician has to deal.

Whether inflammation of the pleura ever occurs as a strictly primary disease is still a mooted point. Cases are occasionally observed clinically in which both the serous and purulent forms of the disease appear to be primary, but these are extremely rare. Acute pleurisy may, however, follow inflammation of the lung so rapidly that it is not easy to determine that the lung was first affected. In infants, extension from the lung is almost the sole cause. It occurs both with lobar and broncho-pneumonia, existing to some degree in nearly every case in which there is consolidation of the lung. Next in frequency to simple pneumonia as a cause of pleurisy are the tuberculous processes of the lung. Tuberculous pleurisy without tuberculosis of the lungs or the bronchial glands is of doubtful occurrence. Acute pleurisy is not an infrequent complication of the infectious diseases, particularly scarlet and typhoid fevers, measles, and influenza. In most of these cases also it is secondary to disease of the lung. Pleurisy in older children occasionally follows cold and exposure.

although it is doubtful whether in any case this is the only cause. In them also it may occur as a complication of rheumatism.

The most important cause of acute pleurisy being extension from pneumonia, it follows that it is most frequent in the cold season, that it occurs more often in males than in females, and between the ages of one and five years. It may, however, be seen at all ages, and may even occur in intra-uterine life. The youngest case in which I have found extensive pleuritic adhesions as an evidence of previous inflammation was in an infant of three months, who died at the Randall's Island Hospital. In this case firm connective tissue adhesions were found over the whole of both lungs.

DRY PLEURISY.

In infants and young children this usually accompanies pneumonia or tuberculous processes in the lung. In older children it may be primary.

Lesions.—On account of the frequency with which this occurs in pneumonia we have an opportunity of observing it in all stages. In the mildest varieties it affects only the pulmonary pleura, and occurs over the pneumonic areas. The pleura is injected, has lost its lustre, and appears dull or roughened. This is due to an exudation of fibrin upon its surface. If the process continues, more fibrin is poured out, and there are in addition swelling and a proliferation of the connective-tissue cells, and an exudation of leucocytes from the blood-vessels. The pleura is then coated with a layer of fibrin of variable thickness, in which are entangled pus cells and new connective-tissue cells. The layer of fibrin varies from the thickness of tissue paper to that of an ordinary book cover. In recent cases it may easily be stripped off, while in older ones it becomes organized and is firmly adherent. The colour of the exudate varies with the number of pus cells. It is gray, grayish-yellow, or yellowish-green, according as these cells are few or numerous. As a rule, dry pleurisy is localized, but the two opposing surfaces are affected. Part of the exudate is usually absorbed, but it is doubtful if complete recovery occurs, there being left behind some adhesions between the visceral and parietal layers.

In some cases of dry pleurisy there is an excessive exudation of pus cells. These cases are most common in young children, and usually occur with pneumonia, constituting what is known as "pleuro-pneumonia." The process is essentially the same as in the cases just mentioned, yet the gross appearance differs very much from ordinary dry pleurisy. The lesions have already been described under the head of Pleuro-Pneumonia (page 532).

In the dry form of tuberculous pleurisy there may be only an exudation of fibrin, or the pleura may be covered with gray tubercles and yellow tuberculous nodules. These are not only seen upon the pleura, but develop in the exudation. In this form, which is usually chronic, great thickening of the pleura may take place. Both the serous and purulent effusions occurring in conjunction with tuberculosis are likely to be sacculated because of the previous existence of adhesions.

After nearly every case of dry pleurisy there probably remains some slight thickening of the pleura. In certain cases there follows a chronic inflammation of the pleura with the production of new connective tissue, which results in thickening and adhesions, which may be so extensive as to entirely obliterate the pleural cavity. Either one or both sides may be affected. This form is extremely rare in childhood.

Symptoms.—As an independent clinical disease, acute dry pleurisy has no existence in infancy or early childhood. The cases which are occasionally so diagnosticated have in my experience invariably proven to be broncho-pneumonia. In children from ten to fourteen years old, dry pleurisy may occur under the same conditions as in adults.

The symptoms are sharp, localized pain, increased by full inspiration, sometimes tenderness upon pressure, and a short, teasing cough. The pain is not always felt upon the affected side, and it may be referred to the abdomen. Upon physical examination, dry pleurisy is recognised by the presence of a pleuritic friction sound. This is usually of a moist, crackling character, generally localized, and heard both on inspiration and expiration. It is quite superficial, and not changed by coughing. This form of pleurisy, as a rule, runs a course of a few days or a week, without constitutional symptoms. When dry pleurisy occurs as a complication of pneumonia it is recognised by the signs just mentioned; but it usually causes no new symptoms except pain.

Treatment.—The treatment consists in counter-irritation by mustard, iodine, or blisters, according to the severity of the inflammation, and in the use of opium. Severe pain can sometimes be relieved by firmly encircling the chest with a broad band of adhesive plaster.

PLEURISY WITH SEROUS EFFUSION.

This form of pleurisy is infrequent in children, and under three years it is very rare. It may occur as a complication of pneumonia, nephritis, acute rheumatism, scarlet fever, or any of the other acute infectious diseases. It may be tuberculous. In rare cases it appears to be primary. Bacteria are occasionally present in the exudation, even in cases which do not become purulent, but their number is usually small. The pneumococcus, the streptococcus, and the tubercle bacillus are the forms most often seen.

Lesions.—The early changes are much the same as in dry pleurisy, but in addition serum is poured out from the blood-vessels, in some cases almost from the beginning of the inflammation. This may be small in amount, or it may fill the pleural cavity. The lesions are similar to those seen in adults, except that there is apt to be more fibrin in children. The process usually terminates in absorption of the serum, but, as in dry pleurisy, more or less extensive adhesions are left behind from the fibrinous exudation.

Symptoms.—The small serous effusions of one or two ounces, occurring with the dry pleurisy that complicates pneumonia, rarely cause either symptoms or physical signs by which they can be recognised. In the present connection only those cases will be discussed in which the amount of effusion is considerable. This form of pleurisy sometimes follows a well-defined attack of pneumonia. Other cases come on with acute febrile symptoms somewhat resembling those of pneumonia, but with all the symptoms less severe, except the pain. After an illness of only two or three days the chest may be found full of fluid. In a third class the disease comes on insidiously, with little or no fever, and often with no distinct pulmonary symptoms except shortness of breath. There are general weakness, sometimes loss of flesh, anæmia, and moderate prostration; but usually the patients are not sick enough to go to bed. The symptoms of pleurisy with effusion vary greatly. When it occurs as a complication of some acute infectious disease, it is often latent, and the diagnosis is to be made only by the physical examination of the chest.

The usual course of the disease is for the fluid to disappear gradually by absorption, the case going on to spontaneous recovery. Serious symptoms resulting from pressure upon the heart and lungs are not common, but may occur when the fluid accumulates rapidly; hence they are most likely to be seen early in the attack. There may be great dyspnœa, sometimes orthopnœa, cyanosis, weak pulse, and even attacks of syncope. Death may occur with these symptoms. In certain cases there is seen no tendency to spontaneous absorption, and the exudation may remain stationary for months. There may then be fever, usually slight but sometimes quite regular, with a decline in the general health, pallor and anæmia, which may strongly suggest the existence of pus, although this is not present. Others are regarded as cases of tuberculosis.

Physical Signs.—The signs in the chest are essentially the same whether the fluid is serous or purulent. On inspection, there is diminished movement of the affected side, sometimes bulging of the intercostal spaces, and if the effusion is large, an increase in the measurement of the affected side of the chest. The apex beat of the heart will usually be considerably displaced if the effusion is upon the left side. It may be found at the epigastrium, at the right border of the sternum, or even in the right mammary line. In disease of the right side the displacement is less, and occurs only with a large effusion. It may then be found in or near the left axillary line. On palpation, the vocal fremitus is usually diminished or absent, but it may be but little changed. Percussion gives marked dulness or flatness. In a large effusion this is over the entire lung. There is also a sensation of increased resistance appreciable by the percussing finger. With a smaller effusion there is usually flatness over the lower part of the chest and dulness or tympanitic resonance above; sometimes dulness is found behind and tympanitic resonance at the apex in front. The line of flatness may change with the position of the patient. The signs on auscultation are variable, and probably lead to more frequent mistakes in diagnosis than in any other pulmonary affection. Bronchial breathing and bronchial voice over the fluid are the rule in children; they are generally more distinct the greater the effusion. Absence of both voice and breathing is sometimes met with, but it is exceptional. The bronchial breathing over fluid usually differs from that over consolidation, in that it is feebler and distant; in some cases, however, it is indistinguishable from that heard over consolidation. Friction sounds may be heard above the level of the fluid, or when the fluid is subsiding, and there may be bronchial râles.

Diagnosis.—The most reliable signs for diagnosis are displacement of the heart, flatness on percussion, absence of râles and friction sounds, and (usually distant) bronchial breathing. In an infant, flatness should always lead one to suspect fluid. If there is flatness over one entire lung, the existence of fluid is almost certain. Between serous and purulent effusions a positive diagnosis is possible only by the use of the exploring needle. This should be employed in every case, as for treatment it is important to know at once whether or not we have a purulent effusion to deal with. The amount of fluid in serous pleurisy is generally less than in the purulent variety.

Pleurisy is further to be differentiated from pneumonia, and from tuberculosis. From pneumonia, the acute cases are distinguished by the lower temperature, the less severe prostration, and the fact that all the general symptoms are milder, but especially by the physical signs. The differential diagnosis by the physical signs between effusion and the various forms of consolidation is considered under the head of Empyema (page 552).

Prognosis.—These cases, as a rule, terminate in recovery, death being very infrequent. In cases coming on without definite cause there should always exist a suspicion of tuberculosis, and hence every patient should be closely watched for the development of the other signs of that disease.

Treatment.—In the great majority of cases, only symptomatic treatment is required during the acute period. The patient should be kept in bed, and pain relieved by opium, counter-irritation, or hot poultices. After the fever has ceased the patient may be allowed to sit up, but all exertion should be carefully avoided if the effusion is large. Sudden death has often occurred when this rule has been violated. The patient should in suitable weather be kept in the open air as much as possible. In the course of a few weeks the effusion usually subsides under simple tonic treatment. Absorption may sometimes be hastened by counter-irritation and diuretics; but convalescence is apt to be slow, and it may be several months before the health is entirely restored.

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Bacteriology.—Much light
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1. Those containing the pne
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infection from the lung.

2. Those containing other

coccus pyogenes and the staphylococcus. Of these the streptococcus is the most important. It may be found alone, but is usually associated with the pneumococcus. This combination is likely to be found in cases secondary to the pneumonia which occurs with the infectious diseases. The streptococcus and staphylococcus occur in the pleurisy of pyæmia, and usually also when the disease is due to the rupture of abscesses into the pleural cavity.

3. The cases due to tuberculosis. In this group the presence of the tubercle bacillus is very often difficult to demonstrate, and it may be absent. From this fact the statement is made by Levy that, if no bacteria can be found in a purulent exudate, tuberculosis should always be suspected. It is not, however, safe to conclude that under these circumstances tuberculosis is always present.

Of nineteen successive cases of empyema occurring in my own practice, the pneumococcus was found alone in fourteen; the streptococcus alone in three; the pneumococcus and streptococcus in one; and the staphylococcus alone in one.

Lesions.—This is an inflammation with the production of serum, fibrin, and pus. In most of the cases—and the younger the child the more frequent its occurrence—empyema succeeds the form of pleurisy in which there is first an exudation of fibrin with an excess of pus cells (*vide supra*). As the process continues, more and more pus is poured out, with serum. At first the fluid collects in small pockets formed by the slight adhesions. As it accumulates these are broken down, and the pleural cavity may be filled with pus. If the original inflammation involved but a portion of the pleura the empyema may be sacculated. This is often seen even in infants. Sacculated empyema is usually posterior, but may be in any part of the chest. In very rare cases there may be several sacs containing pus, separated by septa. This I have never seen in empyema following pneumonia. The cases just described are those in which, in infants and young children, the pneumococcus is regularly found. The amount of fibrin is large, covers both surfaces of the pleura, and many large masses float in the fluid. The pus is usually thick, creamy, and odourless. In another group of cases the evidences of inflammation of the pleura are much less marked, and in some they may be slight. There is but little fibrin in the exudate, and adhesions are rare. In this form the streptococcus or the staphylococcus are the organisms usually found. In these cases the inflammation may be purulent from the outset, and the pus is thinner than the preceding variety. It is rare that empyema in a young child results from a serous effusion which has been gradually converted into a purulent one. I can recall but a single instance.

Even when the fluid is moderate in quantity it is not all at the bottom of the chest, but is generally distributed over a considerable part of its surface, and its depth at the middle and upper part of the chest may be only half an inch, or even less. When the accumulation is larger, the lung does not float on the surface of the fluid, but the fluid surrounds the lung, which is compressed on all sides (Fig. 99). The heart is displaced; the diaphragm and the abdominal viscera are somewhat depressed, and there may be bulging of the chest on the affected side. The amount of fluid in ordinary cases is from half a pint to two pints, although in neglected cases it may accumulate until it amounts to four or five pints. The effect upon the lung will depend upon the amount of fluid and the duration of the compression. When the quantity is small, or when the pressure is removed early, the lung in most cases readily expands, air being forced into it from the opposite lung, especially during the act of coughing. If the pressure is great and has been long continued, the adhesions over the lung may become so dense and firm that expansion is difficult, and can at best be only partial. In such cases recession of the chest wall occurs. In very old cases, expansion is still further interfered with by the changes taking place in the lung itself, usually a low grade of interstitial pneumonia.

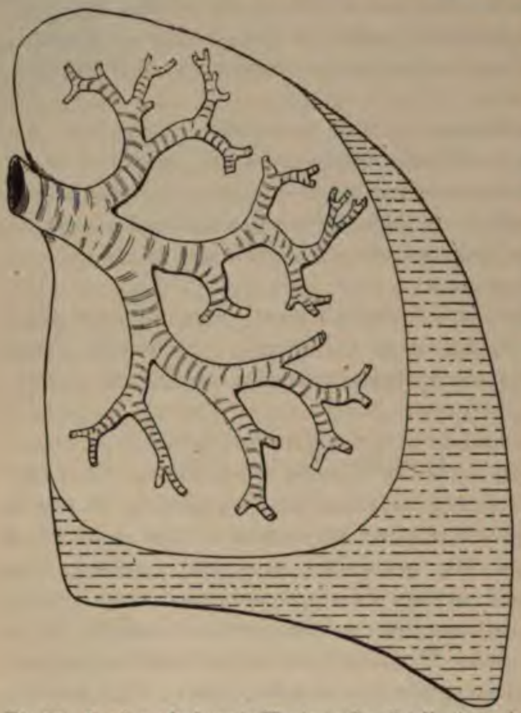

FIG. 99.—Section of a lung to illustrate the distribution of the fluid in the chest in a moderately large effusion (diagrammatic).

In cases of empyema receiving proper surgical treatment reasonably early, full expansion of the lung occurs, and, with the exception of adhesions, recovery may be complete. Although wide in extent, the adhesions are not usually strong enough to interfere seriously with the function of the lung. In cases receiving no treatment, absorption of the pus is possible, but is not to be expected. It generally seeks an external outlet; the lung may be perforated and the pus evacuated through the bronchi, or external rupture may occur, generally in the neighbourhood of the nipple. In still other cases the pus may burrow along the spine, or through the diaphragm may reach the peritonæum.

Empyema is more often of the left than of the right side, the proportion being about three to two. It is double in about three per cent of the cases. The most serious complication in young children is pericarditis, which usually occurs with empyema of the left side. In older children the most frequent complication is pulmonary tuberculosis.

Symptoms.—When it occurs as a sequel of pneumonia, the symptoms of empyema may follow those of the original disease without any intermission; or after the temperature has been normal or nearly so for several days it may rise again, sometimes quite suddenly, but more often gradually. With this accession of fever there are other symptoms pointing to an increase in the thoracic disease. After scarlet fever or other infectious diseases, the onset of empyema is often signalized by cough, rapid breathing, and the other usual symptoms of pulmonary disease. In the cases where empyema appears to be primary, the onset is sudden, with high temperature and general and local symptoms resembling those of pneumonia. After such a beginning, the chest may be found full of pus by the third or fourth day. In rare cases empyema may come on with gradual, and even insidious, symptoms, there being only slight fever, dyspnœa, and cachexia. This is usually seen in older children.

Whatever may have been the mode of onset, when the pus has been in the chest for some time the symptoms are fairly uniform. There are cachexia, pallor, anæmia, and prostration which is generally sufficient to keep the child in bed. The respirations are always accelerated, being usually from forty to seventy a minute. Cough is present; there is dyspnœa, sometimes marked, but more often it is scarcely noticeable. Fever is exceedingly variable; it is rarely high, not often above 102° or 103° F.; in many cases it is not over 100° F., and it may be absent altogether. A typical hectic temperature with sweating, is in my experience very rare. The pulse is rapid but of fair strength. There is loss of flesh, sometimes even emaciation and anorexia; occasionally there is diarrhœa. In chronic cases the general symptoms may closely resemble those of tuberculosis. There may be clubbing of the fingers, albuminuria, and even swelling of the feet.

Diagnosis.—The physical signs do not differ essentially from those present in serous effusions (page 546). Usually the history and the constitutional symptoms enable us to make a diagnosis between serous and purulent effusions with tolerable certainty. If the patient is under three years of age, the fluid is almost certain to be purulent; and from the third to the seventh year, pus is much more often found than serum. In every case in which fluid is suspected the exploring needle should be used, because of the great importance of an early diagnosis. The skin should be washed, the needle sterilized, and the arm raised so as to separate the ribs. Pus may not be found because the needle is too small, too short, or because it is introduced too far into the chest; for when the layer of pus is thin the needle may be pushed through this into the lung. If the physical

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usually over a single lobe, râle
displacement of the heart. E
or over the lower half of the
friction sounds, and the heart is
it is generally, but not always,
may get bronchial breathing
consolidation due to acute p
generally arises from placing
signs. Here also the flatness,
distant character of the bronc
the diagnosis. In pleuro-pneu
the signs may be identical wit
is not displaced. I have once
of an entire lobe which gave sig
lated empyema. It is by the
empyema is positively different
er diseases than those of the
particularly typhoid fever and
tinguished by the physical exa

Prognosis.—The outcome o
factors: the cause, the age of
and the treatment. The best r
pneumonia. Tuberculosis befo
quent cause, and gangrene of t
causes in early life. The three
which make the prognosis of th
but two deaths in children over
In one case operation was refus
tiple abscesses of the lung. T
under one year is high—fully
der age, but because of the wr
Empyema in older children, s
eight weeks—and receiving pr
nates in recovery, unless the
The longer operation is delayed

difficult the expansion of the lung, the more tedious the disease, and the greater the likelihood of a sinus remaining. With proper early treatment these patients not only recover, but they recover perfectly, and in most cases rapidly. Retraction of the chest and its resulting lateral curvature of the spine are extremely rare, and seen only in neglected cases. In the great majority of the cases I have seen, in which a reasonably early operation was done, it was impossible, after the lapse of one or two years, to detect any difference whatever in the physical signs of the two sides of the chest. There is no serious disease the treatment of which is usually more satisfactory than that of acute empyema in a young child.

Spontaneous recovery in empyema may take place by absorption; but this is so rare that it is never to be expected, although there is conclusive evidence that it is possible. The pus may be evacuated spontaneously through a bronchus, rupture having taken place through the visceral pleura. When this occurs, a large amount of pus may be coughed up in a few hours, usually followed by immediate, but not always lasting, improvement. This is the most favourable of the natural terminations. External opening may take place, usually about the nipple. There is an area of redness, then a fluctuating tumour, and finally the pointing of an abscess. The discharge may continue for months, or even for years. External opening rarely occurs until the disease has lasted several months. Of 19 cases of empyema in children collected by Schmidt, in which a spontaneous discharge of pus occurred either externally or through a bronchus, there were 17 deaths and 2 recoveries. Empyema may burrow behind the diaphragm into the abdominal cavity, appearing as a psoas abscess; it may burrow posteriorly into the lumbar region; it may rupture into the œsophagus, or through the diaphragm into the peritoneal cavity. All these conditions, however, are very rare. The chances of spontaneous cure in empyema are small. Of 32 cases, reported by Rilliet and Barthez, which received no surgical treatment, 21 proved fatal. The statistics of empyema before the general adoption of surgical treatment are simply appalling. Patients were either worn out by the protracted suppuration, or died from amyloid degeneration, pneumonia, or tuberculosis.

Treatment.—The medical treatment relates to the patient only; the disease is always to be treated surgically. Like any other acute abscess, empyema requires free incision and drainage with proper antiseptic precautions.

Aspiration as a means of cure has been almost entirely given up in New York. Unquestionably it sometimes suffices to cure empyema, most frequently when it is localized. How often this occurs is shown by the following statistics: Of 139 cases which I collected that were treated by aspiration, 25 were cured, 8 of these by a single aspiration; 13 died, and the remaining 101 were afterward subjected to other treatment. The objections to aspiration are: That it is not possible to remove all the pus; that it

affords no opportunity for tl
ent in large quantities in th
ble means of cure. The ter
great as that of incision wi
is lost, the disease is undul
subsequent incision are great
advised only for temporary
the symptoms are urgent.
the immediate symptoms, in
under these conditions its a
to question.

Puncture with a trocar
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Simple incision and dra
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patient's general condition
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can be obtained by puncture
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used at the time of operation
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and the opening in the pleura
of the operator to pass into th
rarely sufficient to require a lig
opening should be removed w
by forceps or a tracheal dilator
moved at the time; or, if the
be immediately inserted and t
should be of heavy rubber, fen
diameter and four or five inche
of the empyema. To secure it
should be transfixed by a larg
often advisable to insert two tu
ger of stopping the discharge
Iodoform gauze is placed over

compress of the same over the opening of the tube, the dressing being completed by a large mass of absorbent cotton and a snug roller bandage. The pus now slowly escapes into the dressing as the lung expands. The pad of gauze placed over the end of the tube acts as a valve, preventing air from entering the chest, although permitting pus to escape as the lung is expanded by inspiration or by the act of coughing. When there is no reason for haste during the operation, a larger part of the pus may be removed before the application of the dressing. This should be allowed to escape slowly, the opening being closed from time to time by a compress. From ten to twenty minutes should be consumed in evacuating the pus.

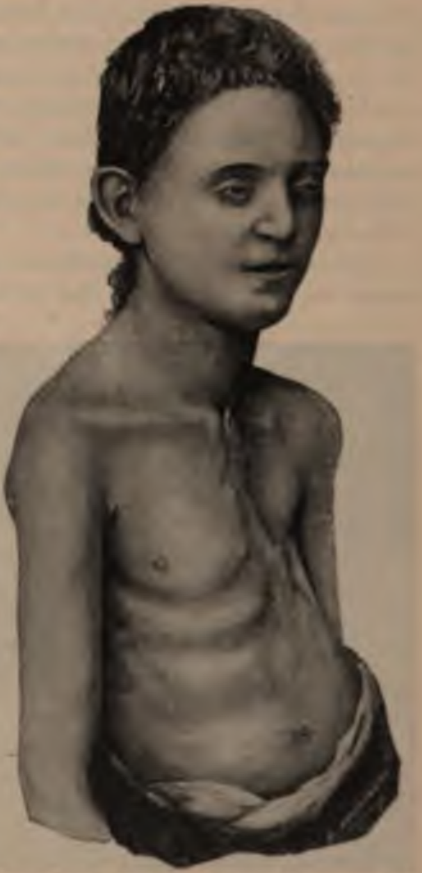

FIG. 100.—Deformity after an old empyema of the left side for which Estlander's operation was performed. Portions of five ribs were removed. (From a photograph seven years after operation.)

For the first two days the dressings should be changed twice daily, then once a day for ten days or two weeks, and later at longer intervals. The tube is gradually shortened at each dressing, until, at the end of a week or ten days, it is reduced to the length of two inches. After the fourth or fifth day a smaller tube may be substituted. Usually by the end of the third week, and often by the end of the second, the tube may be dispensed with altogether, the tract being kept open by the introduction of a narrow strip of iodoform gauze. The time of redressing and the removal of the tube is determined by the amount of discharge and by the temperature. While this does not usually rise after the second day, unless the drainage is imperfect, it may do so when the lung does not expand properly, or when there is still active disease in the lung itself, as is not very uncommon in the cases coming on most acutely. The drainage tube is very liable to be blocked by masses of fibrin, even when one of large size is used. This is the first thing to be suspected if the temperature rises. At each dressing it is well to remove the tube to see if it is clear. The mistake is often made of allowing the

drainage tube to remain to
which would otherwise hea
tube to remain for a long ti
and even necrosis of a rib.
only in cases in which the p
for the purpose of removing
For this a warm sterilized sal
not found this necessary. I
employed. The usual durati
incision is from three to si
The earlier the operation th
with which the lung expands

Resection of a rib.—Many
procedure, with the belief t

FIG. 101.—James' apparatus for expan
after empyema.

usually the cases in which the
average time. One inch of rib
periosteum is preserved, and th

In chronic cases, or those w
ther operative treatment is of
which have opened spontaneous
coming under observation. Th
that further expansion is impos
to its utmost, so that the ribs a

which can not close. For such cases the only hope is in an operation by which portions of several ribs are removed, thus allowing a greater collapse of the chest. This is known as thoracoplasty, or Estlander's operation. The operation is of itself a serious one, and only to be advised as a last resort in inveterate cases. By it, however, life may be saved in some that are otherwise hopeless. Such an operation is, of course, always followed by very great deformity (Fig. 100).

Methods of inducing expansion of the lung.—In most of the cases, particularly the recent ones, complete expansion of the lung takes place without any difficulty, the chief agent being the cough. In some cases this may be insufficient. The apparatus shown in the accompanying cut (Fig. 101), devised by James (New York), serves at the same time as a toy for the child's amusement and as a most efficient means of inducing forced expiration. One bottle is placed a few inches higher than the other, and the child blows a coloured fluid from the lower into the higher bottle, allowing it to siphon back. By raising the second bottle, a greater expiratory force is required. This may be regulated at will. The apparatus may be used for a few minutes several times a day, and particularly in cases of long standing it is of great assistance in producing pulmonary expansion. Blowing soap bubbles often answers the same purpose.

SECTION V.

DISEASES OF THE CIRCULATORY SYSTEM.

CHAPTER I.

PECULIARITIES OF THE HEART AND CIRCULATION IN EARLY LIFE.

The Fœtal Circulation.—During the latter part of fœtal life the circulation may be briefly described as follows: The purified blood comes from the placenta through the umbilical vein. Entering the body, it divides at the under surface of the liver into two branches, the smaller one, the ductus venosus, communicating directly with the inferior vena cava; the larger branch joining the portal vein, so that its blood traverses the liver, and then enters the inferior vena cava through the hepatic vein. From the inferior vena cava the blood enters the right auricle, like that returned from the head and upper extremities by the superior vena cava. A part of the blood now passes directly into the left auricle through the foramen ovale; the remainder, through the tricuspid orifice into the right ventricle. As the requirements of the pulmonary circulation are not great, only a small part of the blood is sent through the pulmonary artery to the lungs; the greater portion passes from the pulmonary artery through the ductus arteriosus into the aorta, joining here the blood from the left ventricle. The blood thus finds its way from the right heart to the left, only in small part by way of the lungs, the greater part passing directly from the right auricle to the left, or from the right ventricle into the aorta through the ductus arteriosus. From the aorta, the blood reaches the placenta through the umbilical arteries, which are a continuation of the hypogastric arteries, which in turn are given off from the internal iliacs.

Changes in the Circulation at Birth.—With the ligature of the umbilical cord, the circulation through the umbilical vein and arteries and the ductus venosus ceases. With the establishment of respiration and the consequent increased demands made by the pulmonary circulation, the blood ceases almost at once to pass through the ductus arteriosus, and very soon through the foramen ovale. The umbilical vessels during the first few days of life are filled with small thrombi, which become organized. By the end of the first week, these vessels, as well as the ductus venosus, are usually closed at their extremities, although they may remain patulous throughout the greater part of their extent for several weeks. They subsequently atrophy to the condition of small fibrous cords. For some weeks before birth the circulation through the foramen ovale is slight, it being gradually obstructed by the growth of a septum which nearly fills the space at birth. After the first week of extra-uterine life very little, if any, blood passes through it, although complete closure of the foramen often does not take place until the middle of the first year. In fully one fourth of the autopsies I have made upon infants under six months old, there have been found minute openings at the margin of the foramen ovale, but they are usually oblique, and closed by the valvular curtain so as effectually to obstruct the current of blood. The ductus arteriosus is first closed by a clot, which becomes organized and blends with the products of a proliferating arteritis. It is rarely found open after the tenth day, and by the twentieth it is almost invariably obliterated.

The Pulse.—The pulse in early life is not only more frequent, but it is very much more variable than in adults. The following is the average pulse-rate in healthy children during sleep or perfect quiet:

Six to twelve months	105 to 115 per minute.
Two to six years	90 " 105 " "
Seven to ten years	80 " 90 " "
Eleven to fourteen years	75 " 85 " "

The pulse is a little more frequent in females than in males, and more frequent when sitting than when lying down. Muscular exercise or excitement increases the pulse-rate by from twenty to fifty beats. Very trivial causes disturb not only the frequency but the force of the pulse. The pulse in young infants may be irregular even in health and during sleep. When rapid, it is frequently irregular without any meaning. No dicrotism is seen in the pulse wave of early infancy, according to Blanche.[*]

The circulation is much more active in infancy than in later childhood; thus, according to Vierordt, the entire round of the circulation is accomplished in the newly born in twelve seconds; at three years, in fifteen seconds; in the adult, in twenty-two seconds.

Size and Growth.—The relative size of the heart is slightly greater in infancy than in later life, it being smallest at about the seventh year. The average weight at the different periods of life is as follows:[†]

Age.	Ounces.	Grammes.	Ratio to body weight.
Birth	0·50	14	1 to 225
1 year	1·25	35	
2 years	1·87	53	
3 "	2·25	64	
7 "	2·80	80	1 to 280
14 "	5·84	166	1 to 222
Adult	8·50	241	1 to 226

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[*] See tracings in Archives of Pædiatrics, vol. v, p. 732.

[†] The figures in infancy are from one hundred and fifty-five observations made in the New York Infant Asylum; the others are taken from Sahli.

The growth of the hea
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to the tenth year, and m
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ever, grows very much mo
of the second year the rati
childhood.

Position of the Apex Be
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the adult. This is partly d
The apex beat is therefore
life. According to the obs
combined examinations with
2,100 children, the apex beat
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it can not be considered abn
the apex beat is in or near th
under normal conditions, it
first year the apex beat is
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in the fourth and the fifth sp
the thirteenth year it is alw
position of the apex beat may
ties of the chest resulting fro
of the spine.

Examination of the Heart
a frequent and important sig
cardiac impulse is generally w
cult to locate the apex beat
covering the chest.

Palpation.—This is usuall
inspection for determining th
pose the child should be in
slightly forward. Great displ
cant, and should lead one to
displacement to the left indic
tricle; to the right, hypertroph
genital malformation.

Percussion.—This is best
A light blow should be used, o
the chest walls. The outline
especially in small children, is
This may lead to the mistaken

is really of normal size. According to Sahli,* the limits of this area are as follows: Above, the second space or lower border of the second costal cartilage; to the right, at the para-sternal line, sometimes slightly beyond it; to the left, at or slightly beyond the mammary line, this depending upon the age of the child. The lower border is indeterminable on account of the liver.

The area of "absolute cardiac dulness," or that part of the heart uncovered by the lung, resembles in shape the same area in the adult, but it is relatively larger. Its upper limit is the upper border of the third intercostal space, sometimes the third costal cartilage; it extends to the left to a point between the para-sternal and the mammary lines, and to the right as far as the left border of the sternum. These two areas will be readily understood by reference to the accompanying diagram (Fig. 102).

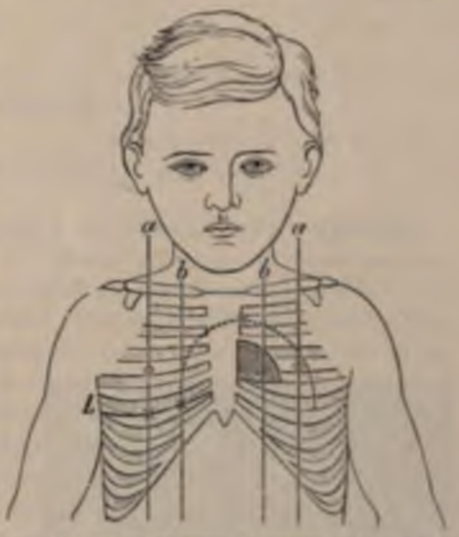

FIG. 102.—Showing areas of cardiac dulness: *a* is the mammary line; *b*, the para-sternal line; *L*, the upper border of the liver. The space enclosed by the dotted line represents the area of relative dulness; the heavily shaded area, that of absolute dulness. (After Sahli, slightly modified by Unger.)

Auscultation.—This is of little value unless the child is quiet. The preferable position is the sitting posture. For an accurate diagnosis the stethoscope is indispensable, but auscultation should always be practised with the naked ear as well. The rhythm and rapidity of the child's heart action are much more easily disturbed than are the adult's, and such disturbances are consequently much less significant. The rapidity of the heart in infancy is ordinarily so great as to make it practically impossible to distinguish between diastolic and presystolic murmurs. Normally, the loudest sound is the first sound at the apex; the weakest sound is the second sound at the aortic orifice. According to Hochsinger, the accentuation of the child's heart-sounds is upon the first sound, and not upon the second, as in the adult.

In consequence of the small size and the thin walls of the chest, all sounds, both normal and pathological, appear relatively louder than in the adult, and the area of diffusion is therefore much greater. Thus it is a frequent occurrence for murmurs to be heard all over the chest both in front and behind.

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* Topographische Percussion im Kindesalter, 1882.

Reduplication of the hea
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may be due simply to exci
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Accidental murmurs ma
tions, and, although not so
means rare even in infants.

CONGENITAL

Etiology.—The causes of
grouped under three general

1. Malformations resulti
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nary artery from the aorta. S
tions which are normal in the
be atresia of any one of the o
leaflets, or of any one of the l

2. Fœtal endocarditis. T
the time of its occurrence. I
frequently affecting the pulm
leads not only to hypertrop
the normal development of
auricular or ventricular septu
open by way of compensation.

3. Persistence of fœtal con
arteriosus. This may be th
stated, or of some condition o

Lesions.—In the following
hundred and forty-two cases,
ture:

Frequency of the different lesio
ca

Defect in the ventricular septum...
Defect in the auricular septum or pa
ovale.........................
Pulmonic stenosis or atresia.......
Patent ductus arteriosus...........

Abnormalities in the origin of the great vessels.	45	cases;	the only	lesion in	0	cases.
Pulmonic insufficiency	17	"	"	"	0	"
Tricuspid insufficiency	6	"	"	"	0	"
Tricuspid stenosis or atresia	3	"	"	"	0	"
Mitral insufficiency	1	"	"	"	0	"
Mitral stenosis or atresia	6	"	"	"	0	"
Aortic insufficiency	1	"	"	"	0	"
Aortic stenosis or atresia	6	"	"	"	0	"
Transposition of the heart	2	"	"	"	0	"
Ectocardia	1	"	"	"	0	"

The most frequent associated lesions.

Pulmonic stenosis, with defect in the ventricular septum	92	cases;	the only	lesion in	20	cases.
Pulmonic stenosis, with defect in the auricular septum	52	"	"	"	8	"
Defects in both septa	82	"	"	"	17	"
Pulmonic stenosis and defects in both septa	36	"	"	"	21	"

From this table it will be seen that, in the great majority of cases, several lesions are present, the most frequent combinations being pulmonary stenosis with defective ventricular septum, pulmonic stenosis with defective auricular septum, the three lesions associated, or the first two with a patent ductus arteriosus.

Defect in the ventricular septum.—This is the most frequent lesion in congenital cardiac disease, and in half the cases was associated with pulmonic stenosis. The defect is generally at the upper part of the septum (Fig. 103). It is usually from one fourth to one half an inch in diameter, but not infrequently there is a large defect, and the septum may be entirely absent, the heart then consisting of but three cavities—two auricles and one ventricle. If the auricular septum also is wanting, as is often the case, the heart has but two cavities. Frequently there are also abnormalities in the origin of the great vessels. The pulmonary artery and the aorta may be given off from the common ventricle, or the aorta may arise partly from one ventricle and partly from the other. If pulmonic stenosis or atresia is present, the opening in the

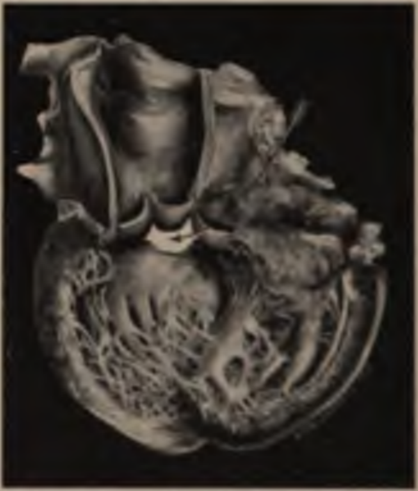

Fig. 103.—Congenital cardiac disease. The left ventricle is shown with a defect in the ventricular septum, the opening being just beneath the aortic valve. (From a patient dying in the Babies' Hospital.)

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the most important. It rarel
pulmonic stenosis or a defect
openings in the auricular sep
infrequently met with in auto
importance. In pathological
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be a failure in development.
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Patent ductus arteriosus.—
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Pulmonic stenosis.—This i
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formation. If the former, the
may be atresia. It is often a
always accompanied by other c
or both septa or by a patent duc
ing more constantly associated
tal lesion. The amount of ob
of the orifice to complete atresia.
is very small, and may be rudim

Pulmonic insufficiency.—Th
the result of fœtal endocarditis,
nary valve. It is most frequen
tricular septum.

Tricuspid, mitral, and aorti
ally seen in cases with multiple
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Abnormalities in the origin
quent; but, as will be seen from
other lesions. Three forms are se
—the pulmonary artery is given
right ventricle. (2) Both arteri
usually due to an incomplete de
tum dividing the two arteries.
be a branch of the aorta. This

other abnormalities, often with so large a defect in the ventricular septum that there is really but one ventricle. (3) The aorta has an abnormal origin, arising from the right ventricle, or partly from both ventricles. This also is associated with a large defect in the ventricular septum. When described as arising from both ventricles, the aorta is usually given off directly above the line of the septum.

In addition to these main deformities, there are many others which need not be more than mentioned. An abnormality in the number of valvular segments is quite a frequent occurrence, but does not usually impair the valve's function. In rare cases a valve is rudimentary, and it may be entirely absent, generally at the pulmonic or tricuspid orifice. Absence of the right auricle and absence of the pericardium have been recorded; also opening of the pulmonary veins into the right auricle, and a single pulmonary artery. In one case in the series there was ectocardia, this being associated with a congenital fissure of the sternum.

Transposition of the heart, or true dextro-cardia, was recorded but twice in this series of cases. It was, however, simulated in several others, including one of my own, where the apex beat was to the right of the sternum. There was in this case great hypertrophy of the right ventricle with a rudimentary ventricular septum.

Secondary lesions.—Since the one condition which nearly all of the congenital malformations of the heart have in common is a persistence of one or more of the fœtal conditions in which the right ventricle does most of the work, it is usually found hypertrophied. It is in most cases accompanied by some dilatation, and often there is dilatation of the right auricle. Changes in the wall of the left heart alone are exceedingly rare. In four cases there was evidence of malignant endocarditis, which was the cause of death, all but one of these patients being adults.

Symptoms.—The symptoms of congenital cardiac disease are usually manifested soon after birth, although this is not always the case. Of 128 cases in which the time of the first symptoms was noted, they were congenital, or appeared during the first month, in 85; after one month and during the first year, in 18; from one to sixteen years, in 15; while in 10 no symptoms were observed until after puberty. Congenital cardiac disease is one of the causes, but not a frequent one, of death during the first few days of life. This may be directly due to convulsions, asphyxia, or syncope.

The most striking objective symptom is cyanosis. This was noted in 88 per cent of the cases in which histories were given. Congenital cardiac disease is very apt to be overlooked when cyanosis is absent, as it may be even with very serious lesions. Cyanosis may be slight and noticed only upon exertion, as upon coughing or crying, or it may be intense and constant, giving the skin a dark, leaden colour, and the mucous membrane of the mouth a raspberry hue. The view that cyanosis depends upon an admixture of arterial and venous blood is generally discredited. In the great majority of the cases at least, the explanation is a deficient oxidation of the blood in the lungs, owing to some interference with the pulmonary circulation. In 63 per cent of the cases of cyanosis in the series, there was found pulmonic stenosis or atresia, or a small pulmonary artery. Cyanosis is of much value in diagnosis, as it is rarely seen in acquired cardiac disease. The degree of cyanosis and its constancy are of some importance in determining the gravity of the lesion, although these alone are not to be depended upon. Another frequent symptom is the enlargement of the terminal phalanges known as clubbing of the fingers (Fig. 104) and toes. This enlargement, which usually involves all the phalanges, is probably due to venous obstruction. Occasionally there are seen dyspnœa, œdema of the lower extremities, dropsy of the serous cavities, and hæmorrhages, particularly hæmoptysis and epistaxis.

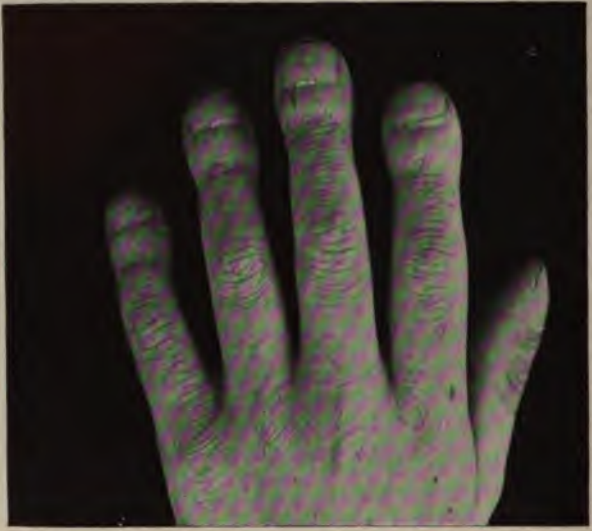

FIG. 104.—Clubbing of the fingers in congenital heart disease. (From a boy five years old.)

Diagnosis.—The most diagnostic features of congenital cardiac disease are cyanosis, the presence of cardiac murmurs, and signs of enlargement of the right heart.

Murmurs were present in four fifths of the cases in which histories were given. The most characteristic is a systolic murmur, loudest at the left base and diffused over a large area. A systolic murmur only was heard in 60 cases, a double murmur in 11, a diastolic and a presystolic in one case each. A systolic murmur may be due to pulmonic stenosis, deficient ventricular septum, patent ductus arteriosus, mitral regurgitation, tricuspid regurgitation, or aortic stenosis. Since these conditions are very often associated, it is difficult to tell upon which one the murmur depends. In over two thirds of the cases in which the murmur was localized it was at the base of the heart, and in the great majority of these it was loudest at the left base, in the second or third space at the border of the sternum and transmitted toward the left shoulder. Apex murmurs were heard in but one fourth of the cases. The murmurs are usually loud, rough, and often out of proportion to the other signs present. Frequently they may be heard all over the chest, both in front and behind. In a young child, a very loud murmur with cyanosis is almost diagnostic of congenital disease, since in acquired disease loud murmurs are nearly always at the apex, and are accompanied by marked hypertrophy.

Enlargement of the right heart, chiefly from ventricular hypertrophy, was present in 86·5 per cent of the cases. In about one half of these there was hypertrophy of the left ventricle, but this was rarely seen alone. The signs of hypertrophy of the right ventricle are: dulness extending to the right of the sternum, displacement of the apex beat to the right, epigastric pulsation, and sometimes bulging of the lower portion of the sternum.

A diagnosis of the precise nature of the malformation is very difficult, and in the great majority of cases only a probable diagnosis is possible. Nearly all the cases are complex, and the variety of combinations is very great. A study of the histories and autopsies of the cases in this series reveals many apparently contradictory facts. Loud murmurs are sometimes heard which are difficult to explain by the lesions, and murmurs may be absent where there is every reason for expecting their presence, as in a case recently under my observation. Certain lesions like aortic stenosis, mitral stenosis, and mitral regurgitation may be accompanied by the same signs as in acquired disease. With reference to the other conditions, I can not do better than give the more frequent clinical symptoms with the results of the autopsies in the series of cases which I have collected.

A systolic murmur at the base, with cyanosis.—This is the most common combination met with, and was present in about one third of all the cases. In over 80 per cent of the cases with these symptoms, pulmonic stenosis was found. The remainder were complicated cases of quite a wide variety. Pulmonic stenosis was usually associated with a defect in one of the cardiac septa, or a patent ductus arteriosus.

A systolic murmur without cyanosis.—In the cases followed to autopsy this was not a frequent combination, being noted but six times, and usually dependent upon a defect in the ventricular septum without pulmonic stenosis, or upon tricuspid regurgitation. Judging from my own clinical experience, a systolic murmur without cyanosis is more common than is indicated by these figures.

A systolic murmur at the apex with cyanosis.—Of the six cases with this combination, all were examples of complex malformation, the most frequent lesions being a defect in the auricular septum, transposition of the great vessels, and patent ductus arteriosus.

Cyanosis without murmurs was noted fourteen times. It indicates either pulmonic atresia or the transposition or irregular origin of the great vessels.

Diastolic murmurs were
monic insufficiency.

A presystolic murmur w
the right base, and the only l

Absence of both cyanosis
The lesions found were: atr
the right ventricle, or defecti

It will be seen that abo
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nearly all the varieties, is of r

Diagnosis of congenital
may be suspected if the patie
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character, or transmission; if
there is cyanosis; and if the
heart.

Diagnosis of congenital fr
difficult matter than to decid
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of cardiac malformation in a
systolic, basic, unaccompanied
in the carotids, often in the s
those due to malformations.
the effect of treatment or th
question.

Prognosis.—Of 225 cases,
fifth year, and nearly one half
16 per cent of the cases lived
years. The prognosis in any
condition of the patient and l
than from the intensity of th
although extreme cyanosis is a

In the cases fatal soon afte
the septa, transposition of the
of twenty-three cases dying thr
sions which are compatible wit
and pulmonic stenosis which c
right ventricle. Many exceptio
have lived a long time in spi
transposition of the pulmonary
Tiedmann's case lived eleven y
—two auricles and one ventri
cases reported by Rokitansky, t

mentary auricular septa and no cyanosis mentioned. Gelpke's case had cyanosis, and lived twenty-seven years with rudimentary auricular and ventricular septa, and with no tricuspid opening.

Treatment.—No treatment is of the slightest avail in diminishing the amount of deformity or promoting the closure of any of the abnormal openings. All cases are to be treated symptomatically.

CHAPTER III.

PERICARDITIS.

INFLAMMATION of the pericardium is a rare disease in infancy and early childhood, only two cases being seen in seven hundred and twenty-six consecutive autopsies at the New York Infant Asylum. In later childhood the disease is more frequent. In its etiology, symptoms, and course it resembles quite closely the same disease in adults.

Etiology.—Of 69 cases of pericarditis in children under fourteen years of age, 24 occurred before the third year, 12 between the third and seventh years, and 33 between the seventh and fourteenth years. It has been seen in the newly born, and has been found even in the fœtus.

Pericarditis is almost invariably a secondary disease, following (1) pleurisy or pleuro-pneumonia; (2) acute rheumatism; (3) acute infectious diseases, especially scarlet fever; (4) pyæmia; (5) tuberculosis; (6) local causes. The relative importance of these causes differs with the age of the child. In infancy and early childhood most of the cases complicate disease of the lung or pleura, usually of the left side. After the fourth year rheumatism takes the first place as an etiological factor. Pericarditis is then generally associated with endocarditis, and may precede or follow the articular manifestations of rheumatism. Following scarlet fever, pericarditis generally occurs in connection with nephritis or multiple joint inflammations. In typhoid fever, also, it is usually associated with pneumonia or joint lesions. Pyæmia may be a cause in the newly born, or it may occur in connection with disease of the bones or joints in older children; in both it is usually associated with similar lesions of other serous membranes. Tuberculous pericarditis is more frequent after the third year, and is generally secondary to pulmonary tuberculosis. Among the local causes may be mentioned traumatism, ulceration of a foreign body from the œsophagus into the pericardium, disease of the sternum, ribs, or vertebræ, and abscesses resulting from cheesy bronchial lymph nodes.

Lesions.—1. *Pericardial transudations*, or an increase in the normal pericardial fluid, are met with in many conditions in which there is a

very marked degree of anæ
larly of the right side. Ge
clear serum are found in th

2. *External or medias*
mediastinal pleurisy, and r
the pericardial and pleura
tissue of the mediastinum.
severe, it may cause compre
any other way produces syn
mation of the internal laye
of the internal layer whicl
other form being preferably

3. *Dry pericarditis.*—Tl
latter, it is more often seen
two opposing surfaces are u
tion they are coated with fi
ally leaves behind bands of
peated attacks there may res

4. *The sero-fibrinous fo*
most common variety. The
which often completely cov
surface to the other. The se
and varies in amount from a
in recovery there is gradua
fibrin, but adhesions more or

5. *Purulent pericarditis.*
body ulcerating into the sac
by general pyæmia, the proc
frequently, however, in puru
exudation of fibrin with pu
pouring out of fluid pus, pr
often associated. If death o
pericardium are found coate
lymph, but little or no fluid
pericardial sac contains pus
ounces to one or two pints.
pneumonia or pleurisy, is usu
any of the pyogenic germs m

6. *Pericarditis with an e*
may occur from the rupture
states such as purpura, and ve

Pericarditis complicating
or fibrino-purulent; that wi
accompanied by endocarditis.

only a deposit of miliary tubercles, or there may be a small serous or serosanguinolent effusion. In chronic cases there may be a tuberculous inflammation with the formation of caseous nodules, new connective tissue, and extensive adhesions. This generally occurs in connection with pulmonary tuberculosis—sometimes with tuberculous peritonitis.

In any form of pericarditis complete recovery, so far as pathological conditions are concerned, is rare—if, indeed, it ever occurs. Generally adhesions remain, which may be in the form of a few thin connective-tissue bands, or so extensive as to produce almost entire obliteration of the pericardial sac. Such adhesions are usually followed by secondary changes. The growth and development of the heart are interfered with, and there may be sufficient pressure upon the coronary vessels to lead to degeneration of the muscular walls and dilatation of the heart. With large fluid exudations there may be an interference with the systemic circulation, enlargement of the spleen and liver, and sometimes general dropsy.

Symptoms.—A pericardial transudation, or dropsy of the pericardium, is very rarely large enough to make a diagnosis possible.

External pericarditis is seldom recognised during life, there being no symptoms except those of the pleurisy with which it is associated. Occasionally there may be heard, particularly if the inflammation is anterior, a pleuritic friction sound which is increased with the systole of the heart. The pulse may be weak during inspiration, and there may be an increased area of cardiac dulness. If the inflammation is chiefly posterior, it causes only the symptoms of mediastinitis, which is recognised principally by its pressure effects upon the great vessels. It may produce œdema of the face or of the lower extremities, ascites, enlargement of the liver and spleen, but rarely albuminuria. It is usually progressive, and lasts from a few months to two or three years, according to its cause.

Inflammation of the internal layer is the only form usually described as pericarditis. This is very frequently overlooked, not only on account of its rarity, but from the obscurity of its symptoms. The difficulty in diagnosis is particularly great in young children. The symptoms are few, and many of them are equivocal. As this disease is nearly always secondary, the physician should be on the watch for it in infants with pleurisy or pleuro-pneumonia of the left side, and in older children in the course of articular rheumatism. Localized pain and tenderness may be present, and also a certain amount of embarrassment of the heart's action, usually manifested by præcordial distress, palpitation, and slight irregularity of the pulse. There may be dyspnœa, and if there is a large effusion present there may be orthopnœa and cyanosis. Sometimes there is delirium. When pericarditis follows pleurisy or pleuro-pneumonia there are frequently no new symptoms added.

The physical signs in older children resemble those in adults. In dry pericarditis there is usually heard a double friction sound over the præcor-

dial space, the area being ge
The sound is not transmitt
movements. After effusion
placed upward, diffused, and
at all. There may be bulgin
absence of vocal fremitus ov
cussion gives an area of ma
the base being below and t
dulness is increased in all di
limits of the heart. On aus
tant. Friction sounds disap
it is absorbed. Endocardial
physical signs are often enti
feeble, distant, or absent.

The usual duration of a
The ordinary dry form, with
subacute or chronic form of
serum is usually absorbed qu
a chronic inflammation foll
of rheumatism. In the pur
death is the most frequent te
taneous opening takes place,
or less extensive adhesions re

Prognosis.—Of thirty-five
ered. This statement is to be
of diagnosis than of a very hi
a serious one. The prognosi
When due to pyæmia or the a
from pleurisy or pneumonia,
primary disease rather than th
the latter may be the case, ho
which the pericarditis itself
pending upon rheumatism.
often be great, yet convalesce
the disease, by reason of adhes

Diagnosis.—Owing to the
acute dry pericarditis present
are not met with in the adult.
three years, that in ordinary
older children the diagnosis is
in adults. Pericarditis with e
tion of the heart and from ple
nosis is not often difficult in
dition, and is rarely extreme

pleuritic effusions the diagnosis is at times almost impossible. Signs pointing to a sacculated empyema of the left side anteriorly should always be regarded with suspicion, particularly if the apex beat is not displaced to the right, and if the heart sounds are very feeble. When empyema and pericarditis coexist, it may be impossible to recognise the condition. The diagnosis between serous and purulent effusions can be made only by aspiration. Fluid effusions in infants are almost invariably purulent, and so also are they in the majority of cases in older children, unless due to rheumatism.

Treatment.—In the early part of an attack of acute pericarditis the patient should be kept in bed and as quiet as possible, and hot poultices or counter-irritation by mustard used over the heart. Sometimes an ice bag may with advantage be substituted. Excessive heart action may be controlled by aconite, and severe pain may require opium. If the disease is due to rheumatism, anti-rheumatic remedies should be employed. Serous effusions usually subside under simple tonic treatment. If absorption is slow, it may be hastened by counter-irritation. When a large effusion forms rapidly there may be danger of death from syncope. Symptoms which indicate an unfavourable termination are cyanosis, weak, irregular pulse, and great dyspnœa, or orthopnœa. Under these conditions aspiration may afford temporary relief, and free diuresis should be induced by citrate of potash and caffein. The inhalation of oxygen is at times of great value in cases presenting such urgent symptoms. If pus is shown to be present by puncture, incision and drainage should be practised, as in empyema. The results of aspiration in such cases are extremely unfavourable. Of eighteen cases of aspiration of the pericardium collected by Keating, only four recovered. In puncturing the pericardium the point usually selected is a little to the left of the border of the sternum in the fifth intercostal space, the needle being directed upward and outward.

CHRONIC PERICARDITIS WITH ADHESIONS.

This is not a very uncommon condition. It may be general or localized. The youngest case which has come under my observation was in a female child sixteen months old, who died from acute broncho-pneumonia. The adhesions were old and general, the pericardial sac being completely obliterated. There was also some old pleurisy present. The history threw no light upon the lesions. As already stated, such adhesions may follow single, but more frequently recurrent, attacks of rheumatic pericarditis. Sometimes the process may be tuberculous. The adhesions may increase until they are one eighth or even one fourth of an inch in thickness. Adhesive pericarditis is usually accompanied by some dilatation of the heart, which may be preceded by hypertrophy, and there may or may not be valvular disease.

Partial adhesions cause no symptoms by which they can be recognised,

and even general adhesions
found at autopsy where no
conditions in which, after
heart, sudden death someti
cardiac symptoms present a
disturbance. The heart is
there is seen bulging of the
fused apex beat. One of the
tole there occurs a retraction
apex of the heart, sometimes
the epigastrium. This is of
inspection. It is followed b
collapse of the jugular vein
bent, is to be seen behind in t
and sometimes on the right si
diac dulness in all directions
called attention to the freque
ing" character in these case
always presents difficulties, b
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of the heart and the frequenc
valvular disease. The lesion
The treatment is symptomati

C

ENDOCARDITIS

ACUTE SI

Acute endocarditis may
usually affects the right side
causes of congenital malform
exceedingly rare, not a single
autopsies upon children under
From the third to the fifth yea
is quite common. Of 95 case
the sixth year, and 80 between

Acute endocarditis may be
secondary disease. The prima
cussion, but I agree with thos
as rheumatic. Cheadle (Lon
upon endocarditis in children

much as a manifestation—often the first—of that disease. Sometimes endocarditis occurs alone, and sometimes it is associated with chorea without articular symptoms; but the latter almost invariably appear sooner or later. Endocarditis is seen as a frequent complication both of acute and of subacute articular rheumatism. The proportion of rheumatic cases in which it occurs is much larger in children than in adults. Compared with rheumatism, all other causes of acute endocarditis are very infrequent. It is seen occasionally in the course of nearly all the acute infectious diseases, most often with scarlet fever, and it sometimes complicates pleurisy and pneumonia, being usually associated with pericarditis. In infectious diseases, and in pleurisy and pneumonia, the endocarditis is probably excited by pathogenic germs. Fraenkel and Sanger have found the staphylococcus in cases of simple endocarditis, and cultures by others have shown the presence of other pyogenic organisms, including the pneumococcus.

Lesions.—Acute inflammation may affect any part of the endocardium, but in extra-uterine life it usually affects the valves of the left side, involving the mitral much more frequently than the aortic valve. Steffen's figures give only four examples of aortic disease in ninety-five cases. (Compare statistics of valvular disease, page 583.)

The pathological changes consist first in an extensive growth of new connective-tissue cells and an infiltration of round cells beneath the endothelial layer. This results in the formation of small masses of granulation-tissue upon the valves or the endocardium of the heart wall, and upon these there is deposited fibrin from the blood. In this way the tiny wart-like excrescences known as vegetations are produced. Bacteria may also be caught in the exudate. As a consequence of the inflammation, the valve is swollen, somewhat shortened, and consequently insufficient. The results of the process may be ulceration of this new-formed tissue, which in ordinary cases is small in amount, or organization and cicatrization. Masses of fibrin may be detached from the vegetations and swept into the general circulation, lodging as emboli in the kidneys, spleen, brain, or other organs. This is not common in acute endocarditis, at least not in the first attacks.

In the milder forms of inflammation it is possible for complete recovery to take place, with the exception of a slight valvular thickening, not enough, however, to interfere in any way with the function of the valves. But this result is rare. In most cases they remain slightly insufficient, as the least serious consequence of the inflammation. Unfortunately, it more often happens that an acute inflammation which may not be at first serious, proves the beginning of the progressive changes of a chronic inflammation, the full effects of which are not seen for years. Chronic inflammation may follow the first attack immediately, or after a considerable interval, or occur after several acute attacks.

Symptoms.—When acute
when it is the only manifesta
with rather severe general
105° F., prostration, exagg
times dyspnœa. There is nc
it is not until the heart is ex
heart is not watched, the dia
picion of the nature of the
existence of valvular diseas
examined from day to day, nc
or fourth day, or even later,
blowing, systolic murmur at
mitted to the left. It may b
ated pulmonic second sound,
tation with the usual signs c
murmur gradually increases
and then in most cases somew

Acute endocarditis somet
ously with, an attack of ch
described. Finlayson (Glasg
a frequent cause of obscure f
ring alone or with articular
during the choreic attack or s
as a complication of articular
temperature and in the severi
thing more definite. Endoca
nised only by the physical sig

The usual duration of ac
the febrile symptoms frequen
symptoms slowly diminishing.

The attack may terminate
to the rapid development of
signs of cardiac insufficiency,
complications. Cerebral emb
hemiplegia, but rarely results
kidneys, they may lead to swel
patient may recover with a
gradually disappears—a rare
mur, with the subsequent dev
disease. Lastly, there may be
ultimate development of chron

Diagnosis.—The diagnosis
made; not because it is difficu
is not examined as frequently

toms are few and not diagnostic. It is therefore of the greatest importance that not only in chorea and rheumatism, but in all acute febrile attacks, particularly those of obscure origin, the heart should be closely watched. Endocarditis affecting the wall of the heart can not be diagnosticated. The murmur of valvular endocarditis may be confounded with pericarditis, or with functional or blood murmurs occurring in the course of acute febrile attacks, or with those of anæmic origin. From pericarditis it is distinguished by the fact that the murmur is single, has a soft blowing character, is usually located at the apex, is transmitted beyond the border of the heart, and is diminished by a full inspiration. Functional murmurs in febrile diseases are quite frequent in young children, and may at first be difficult to distinguish from those of endocarditis. Usually, however, the former are at the base rather than at the apex. They are more irregular, both as to time, transmission, and constancy, than are murmurs resulting from acute endocarditis. The same may be said of anæmic murmurs, which, as in adults, may be heard in the carotids, and sometimes over any of the large arteries.

Prognosis.—The danger to life in acute endocarditis is not often great, as the disease seldom proves fatal. However, death may occur when it is associated with chorea, but here usually when an acute process is ingrafted upon an old valvular disease. In other cases, death results from complications, particularly pneumonia. Only the progress of the case enables one to decide how extensive is the damage which has been done to the valves. There is always the danger of recurrent attacks.

Treatment.—All the so-called primary cases, as well as those occurring with chorea and articular symptoms, should have the benefit of antirheumatic remedies, as this is the only plan which offers any chance of limiting the inflammation, although the effect upon the heart is rarely striking. Excessive cardiac action is sometimes allayed by aconite, sometimes best by opium. The most important thing in the management of these cases, and the one frequently overlooked, is to secure for the heart as complete rest as possible, not only during the period of acute inflammation, but for several succeeding weeks. Patients should be kept in bed for at least a month, and only the slightest exertion permitted for many weeks. It is during this early period of the disease that changes take place most rapidly in the heart walls, and the gravest results sometimes follow the neglect of these precautions. Children are often allowed out of bed as soon as the fever has subsided, and the heart disease is unnoticed until a grave amount of dilatation has developed, with dropsy, palpitation, shortness of breath, slight cyanosis, irregular pulse, and cough. All children who have once suffered from endocarditis should be protected as much as possible against subsequent attacks of rheumatism.

MALIG

Malignant or ulcerative
The youngest case I have fou
in a boy four years old, and
secondary to a cardiac malfo
early life, about twenty-five i
children over ten years of ag
tially from the adult type. I
we are indebted to Osler's G

Malignant endocarditis r
acute diseases, it is most f
rheumatism and meningitis.
ease or septic process. In 7
is ingrafted upon a previous
cases of congenital malform
from malignant endocarditis,

The bacteria most frequ
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cus. These micro-organisms
production of the disease. C
endocardium of the valves, al
diseased.

Lesions.—Malignant endo
tations which subsequently br
tion affecting only the endo
valve, the septum, or even the
tion of the deeper tissues of th
small abscesses at the base of
to large perforations, or even
aneurisms, or abscesses of the
ent parts of the heart are aff
aortic, mitral and aortic com
the cardiac wall. The second
to emboli. These are most
the brain, intestines, and skin
eased, in the lungs. These e
infarctions, to hæmorrhages, o
and tissues in which they lodg

Symptoms.—Malignant en
toms, making the diagnosis ex
cases. There is generally a r
rigors, profuse sweating, low d
tration. In many cases there

diarrhœa is also frequent. The cerebral symptoms may be so prominent as to suggest meningitis. There is usually a cardiac murmur, the location of which depends upon the seat of disease. It is most frequently the murmur of mitral regurgitation. This murmur is sometimes faint, and may be absent. The spleen is in most cases enlarged. From the emboli there may be hemiplegia, rapid swelling of the spleen, bloody urine, cough, and symptoms of pneumonia. The disease lasts from a few days to six weeks, death being the almost invariable termination. It is due to exhaustion or to some embolic process.

Diagnosis.—The most characteristic features of malignant endocarditis are the development of pyæmic or typhoid symptoms with a petechial eruption, in a patient who has previously had valvular disease. Malignant endocarditis is differentiated from typhoid fever by its sudden onset, irregular temperature, recurring chills, profuse sweats, petechial eruption, and dyspnœa. It may be confounded with malarial fever.

Treatment.—This is entirely symptomatic; no known measures have any influence upon the disease itself.

CHRONIC VALVULAR DISEASE.

Chronic valvular disease of the heart in children is usually the result of endocarditis; in a small number of cases it depends upon congenital malformation; but the degenerative lesions to which many adult cases are due have no place in early life.

Lesions.—The changes of chronic endocarditis may be briefly described as follows: The valvular segments are thickened by the production of new connective tissue, the contraction of which results in retraction, shortening, puckering, and imperfect closure of the valves. The valvular leaflets may adhere to each other, so that the opening is very much narrowed. This is sometimes reduced to a funnel-shaped orifice barely admitting the tip of the finger, and it may even be much smaller. The leaflets are sometimes adherent to the wall of the heart; the chordæ tendineæ are shortened, and sometimes entirely disappear; and, finally, the valves may be the seat of calcareous deposits. These changes take place very slowly, requiring many years for their full development. From time to time there may be attacks of acute inflammation. The changes described may bring about (1) valvular insufficiency, owing to imperfect closure, causing a regurgitation of blood through the opening guarded by the valve; or (2) stenosis, with such a narrowing of the opening that the outflow of blood is obstructed. In early life it is usually the mitral valve that is affected.

Of 141 cases in children under fourteen years old, observed clinically by Dr. F. M. Crandall and myself, the mitral valve was alone affected in 79 per cent; the aortic valve alone in 3 per cent; and both were associated in 18 per cent. Lesions of the aortic valve in early life are therefore comparatively rare.

Following valvular lesions, important changes take place in the wall and cavities of the heart: these are hypertrophy and dilatation.

Hypertrophy.—This consists in an increase in the thickness of the heart wall, due to an increase in the size and number of the muscular fibres. It is principally of the ventricles, and is always conservative. It may continue indefinitely, or it may be followed by degeneration and dilatation. Hypertrophy occurs as a result of any obstructive lesion at one of the cardiac orifices, in renal disease when the obstruction is in the small arteries, also when extra work is thrown upon the ventricles as a result of regurgitation, and it may follow primary dilatation.

Dilatation.—This consists in an enlargement of the cavities of the heart, usually with thinning of their walls. It is generally most marked in the auricles. Primary dilatation is produced by regurgitation of blood into any of the cavities as a result of valvular insufficiency. This may to a slight extent be regarded as a conservative lesion. Secondary dilatation, or that resulting from degeneration of the cardiac muscle, is always injurious. It is usually caused by imperfect nutrition of the heart which may be due to local or general causes. In most of the cases both hypertrophy and dilatation continue for a long time. So long as hypertrophy predominates, the circulation may be well carried on; but when dilatation comes to exceed hypertrophy, there are signs of great embarrassment to the circulation and of cardiac insufficiency.

There are other lesions accompanying chronic valvular disease, depending upon obstruction to the venous circulation. If this obstruction is in the pulmonary veins, it leads to congestion of the lungs, chronic bronchitis, or chronic pneumonia; if of the systemic venous circulation, it leads to chronic congestion of the spleen, liver, kidneys, peritonæum, and sometimes to general dropsy.

Etiology.—The following table gives the age and sex in the cases observed by Dr. Crandall and myself:

	1 year.	2 years.	3 years.	4 years.	5 years.	6 years.	7 years.	8 years.	9 years.	10 years.	11 years.	12 years.	13 years.	14 years.	
Males......	..	1	2	2	4	6	4	9	8	6	5	7	6	1	= 55, or 38%
Females...	..	1	3	5	7	9	10	3	11	12	14	4	2	3	= 90, " 62%
Total....	..	2	5	7	11	15	14	12	19	18	19	11	8	4	= 145

The difference in sex is very nearly the same as was found in my cases of rheumatism. Sturges, in 100 cases, gives 56 per cent females and 44 per cent males. Sansom's figures alone give a predominance of males.

The chronic endocarditis of early life is, as a rule, secondary to the acute or subacute form. Its etiological factors are therefore those of acute endocarditis. Of 117 cases in my own series, 93, or 80 per cent, gave a history of previous rheumatism—7 cases of chorea without articular symptoms being included as rheumatic. Of the 31 cases which at the first examination gave no history of rheumatism, 8 subsequently developed articular rheumatism, and 2 chorea, so that nearly 90 per cent of this series of cases presented, to my mind, conclusive evidence of a rheumatic diathesis. Thirty per cent had chorea previously, or developed it while under observation. The more closely I study cases of rheumatism, chorea, and valvular disease, and the longer the patients are kept under observation, the deeper becomes my conviction of the very close relationship between these three conditions in childhood. The percentage of rheumatic cases in this series is considerably larger than that given by many writers, but it corresponds very closely with Cheadle's careful observations. Valvular disease is occasionally traced to an attack of endocarditis complicating scarlet fever, and in rare cases to that occurring with other infectious diseases.

Symptoms.—The symptoms of chronic valvular disease in most cases come on slowly, often insidiously, and frequently there are none until the disease has lasted a long time, the condition being discovered by accident. The course of valvular disease is usually divided into two periods, the first being that while compensation is present, and the second after compensation has failed. The duration of the stage of compensation is indefinite; it may last a lifetime. The only subjective symptom that is of much diagnostic value is shortness of breath on exertion. Occasionally other symptoms are present, such as præcordial pain, attacks of palpitation, headache, epistaxis, anæmia, and cough. These are rarely constant, but come on when the patient's general condition for any reason is below normal. As a rule, there is in young subjects a tendency to an increase in the disease, although this is often slow, and may be interrupted by long periods in which the process appears to be stationary. At such times the patients either have no symptoms, or suffer only from a slight amount of inconvenience on marked exertion.

Failure in compensation is generally brought about by one of the following causes: There may be an intercurrent attack of acute endocarditis, which in a short time leads to a very great increase in the heart's disability. It may be due to additional work thrown upon the heart from excessive muscular exertion, or to the strain of a prolonged attack of some acute illness, especially one that is liable to produce changes in the heart muscle, such as typhoid or scarlet fever. It is sometimes the increased work which is physiologically thrown upon the heart at the time of puberty, owing to the rapid growth of the body. It may result from any cause which seriously affects the patient's general nutrition, particularly when this is associated with marked anæmia.

The symptoms indicating failure of compensation are those depending upon a weak heart, with imperfect filling of the arteries and overfilling of the veins. The embarrassment of the pulmonary circulation leads to constant dyspnœa or orthopnœa and cough, sometimes accompanied by profuse

expectoration, which may be
pulmonary hæmorrhages. T
lation leads to dropsy, which
anasarca and dropsy of the s
pleura; also enlargement a
largement of the spleen, dys
the kidney, with scanty urine
of the superficial veins, with
there may be cerebral sympt
ing attacks. The pulse is s
and irregular.

It is rare to see all the
under ten years, but about th
The symptoms may increase
be severe for a time and the
longer or shorter interval.* D

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* The course and termination
illustrated by the following histor
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symptoms for one year. There wa
with considerable hypertrophy. T
pointed toward acute dilatation. U
disappeared, and she went on comf
years there were frequent attacks
heart lesion steadily increased in sev
subcutaneous tendinous nodules, w
year there was heard for the first tim
marked thrill, mitral stenosis having
gressing endocarditis. This murmu
while the mitral regurgitant murmur
was in the sixth space, two and a
twelfth to the fifteenth year she gre
signs of maturity, the cardiac sym
year she developed a marked enlarge
and all the symptoms of cardiac ins
character since she was seven years o
aortic regurgitant murmur in additio
disappeared under treatment in the c
turned with greater severity and were
from heart failure in a few weeks.
double aortic as well as a double mitr

At autopsy the heart weighed fifte
especially of the right ventricle, whic
much dilated. The most important
admitting the end of the little finger.
The curtains of the aortic valve were
ing of the pulmonic and tricuspid val

to intercurrent nephritis, pneumonia, embolism, inflammation of the serous membranes, or to œdema of the lungs.

Clinical Varieties.—Of the 141 cases of valvular disease in children under fourteen years, previously referred to, the following were the forms and combinations recorded. It is to be noted that these figures are based upon clinical and not pathological examinations:

Mitral insufficiency	131	cases;	alone in	99	cases.
Mitral stenosis	17	"	" "	4	"
Aortic insufficiency	9	"	" "	0	"
Aortic stenosis	28	"	" "	3	"
Double mitral	8	"			
Double aortic	1	case.			
Double mitral and double aortic	3	cases.			
Mitral insufficiency and double aortic	3	"			
Mitral insufficiency and aortic stenosis	18	"			
Mitral stenosis and aortic insufficiency	2	"			

Mitral insufficiency.—This is usually the result of attacks of acute endocarditis. It is by far the most frequent form of valvular disease in early life, occurring in 93 per cent of the above cases, and alone in 70 per cent. In mitral insufficiency there is regurgitation of blood from the left ventricle into the left auricle during systole. This is compensated for by hypertrophy of both ventricles. It causes dilatation of the left auricle, increased pressure in the pulmonary veins, afterward in the pulmonary arteries, hypertrophy of the right ventricle, and, finally, there is dilatation of the right ventricle, tricuspid insufficiency, dilatation of the right auricle, and general systemic venous obstruction. Coincident with the changes in the right heart there is hypertrophy of the left ventricle, followed by dilatation.

In mitral insufficiency there is heard a systolic murmur which is synchronous with the apex impulse and with the first sound of the heart, and may in part replace the first sound. It is loudest at the apex, transmitted to the left, and heard with almost equal distinctness at the inferior angle of the left scapula. This is a very diffusible murmur, and may be audible all over the chest. It is accompanied by an accentuation of the pulmonic second sound heard at the left border of the sternum in the second space, and by signs of hypertrophy of the heart. When both these signs are wanting, the existence of mitral insufficiency is somewhat doubtful, as a similar murmur may be of functional or accidental origin. In the early stages of the disease the signs of hypertrophy predominate; in the later stages, those of dilatation.

In hypertrophy of the left ventricle or of the whole heart, the apex beat is displaced downward and to the left.* It may be in the fifth or

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* For normal position of the apex in childhood, see page 560.

the sixth space, but rarely lo
There is often bulging of the
of the chest. The impulse is
than normal. The area of ca
but particularly downward a
chiefly the right ventricle, th
sternum, and the area of duln
extending from one to one and
sternum. The heart sounds
often have a somewhat metall
ventricle there may be redupl
The pulse is full and strong.

In dilatation the apex b
There is an increase in the are
square. The cardiac sounds
may be lost. The heart's ac
weak.

Mitral stenosis.—This is ap
rheumatism, with a slowly pr
ciated with mitral regurgitatio
lesion obstruction to the flow o
ventricle. It is mainly compe
tricle, but to a certain degree
secondary changes following th
followed by dilatation, increase
by hypertrophy and dilatation
is usually normal or small.

Mitral stenosis produces a
prolonged, usually rough in c
first sound of the heart. It is
over only a small circumscribe
for diagnosis is the presence o
upon palpation, and terminates
The pulse of mitral obstruction
but those which are present dep

Aortic stenosis.—This is n
occurs as the only murmur, be
insufficiency. It is sometimes a
is compensated for by hypertr
complete for a long period, b
tion of the left ventricle, with
In aortic obstruction there is a
from the left ventricle into the a
is usually loudest at the right b

and is transmitted upward, being distinct in the carotids. The second sound is generally weak. There are associated the signs of marked hypertrophy of the left ventricle.

Aortic obstruction is more frequently confounded with conditions giving accidental or functional murmurs than is any other valvular lesion. Without the signs of hypertrophy of the left ventricle, a positive diagnosis should not be made. On account of the almost perfect compensation, this form of the disease causes fewer symptoms than any other variety, possibly excepting mitral obstruction. The danger of embolism is somewhat greater than in mitral disease.

Aortic insufficiency.—This is one of the rarest valvular lesions in children. In no case on my list did it occur as the only lesion. It causes a regurgitation of blood from the aorta into the left ventricle during diastole. It is compensated for by dilatation and hypertrophy of the left ventriclé. The order in which the secondary changes take place is: dilatation followed by hypertrophy of the left ventricle, ultimately followed by further dilatation due to degeneration, this leading to mitral insufficiency with all its remote consequences. The signs of aortic insufficiency are a prolonged diastolic murmur, with, or taking the place of, the second sound of the heart, generally loudest at the left border of the sternum in the second space, and transmitted downward to the apex of the heart or the ensiform cartilage. This is invariably accompanied by signs of hypertrophy and dilatation of the left ventricle, these being usually marked. In the stage of compensation the signs of hypertrophy predominate, and when compensation has failed, the signs of dilatation. A characteristic symptom is the intense throbbing of the carotids, with the sudden distension and complete collapse of their walls, and the "ball-pulse" of Corrigan. Early in the disease there may be headache, flashes of light before the eyes, and other evidences of cerebral congestion. In the late stages there may be fainting attacks. With this lesion compensation may be complete for a long time.

Tricuspid insufficiency.—This is usually secondary to disease of the left side of the heart, occurring in its late stages. It most frequently follows mitral insufficiency, where it is usually due to dilatation of the right ventricle without changes in the valves. It may be secondary to certain diseases of the lungs, such as emphysema, chronic interstitial pneumonia, or chronic pleurisy, and it may be due to congenital malformation. Tricuspid insufficiency gives a systolic murmur, loudest over the lower part of the sternum, but heard usually over a small area. It is generally associated with signs of dilatation of the right ventricle. The jugular veins stand out prominently, and often show systolic pulsation, especially upon the right side. The symptoms associated with tricuspid regurgitation are due to general systemic venous obstruction, already mentioned in connection with mitral insufficiency.

Tricuspid stenosis, puln are practically unknown i disease.

Prognosis of Valvular Dis ease is possible only when th from cardiac disease before death being extremely rare. well up to about the time often failing rapidly. Other up by an intercurrent attack make rapid progress. The pr lesions before the age of eight is comparatively small.

There are several features of which, serious lesions ten The muscular walls are less much more readily than in ad for constant needs, but for the eral nutrition is poor during quickly and seriously upon the but if the general nutrition hold its own throughout child at puberty are especially severe and the frequency of anæmia the danger of rapid advances rheumatism, from which child subjects. Extensive pericardia handicap the heart, greatly in effect upon the heart of poor f malnutrition is much more ma

These unfavourable conditi the child has an advantage ov teries is very rare, and the valv with—mitral insufficiency and of the most complete compensa

In making a prognosis in a or dilatation which exists is of or the special character of the and venous circulation must a rapidly the disease is progressi health, and how well circumst general management. The pre creases the danger from every theria, and scarlet fever.

Diagnosis.—Valvular disease is to be particularly distinguished from conditions in which there are heard functional or accidental murmurs. According to my own experience the latter are quite common even in young children. Mistakes usually arise from attaching too much importance to the presence of murmurs, and too little to the changes in the walls and cavities of the heart, with which valvular disease is almost invariably associated. It is not always possible to decide whether a murmur is organic or functional until the patient has been for some time under observation and treatment, particularly when anæmia is present. The diagnostic points, so far as the murmurs are concerned, are mentioned in connection with anæmic murmurs (page 590).

Treatment.—A child who is the subject of chronic valvular disease should be under constant medical supervision. Irreparable harm often results from wilful, but more frequently from ignorant, disregard of the simplest and most important rules of life for these patients. The facts should be plainly stated, the course of the disease and the dangers fully explained to parents, and, when old enough, to the child himself. At the very least the patient should be carefully examined three or four times each year, in order that the physician may note the progress of the disease, and be able to modify the child's occupation, exercise, and surroundings, in order to meet, so far as possible, the changing conditions. Few patients need more watchful oversight than children with cardiac disease. The greatest care should be exercised, especially in all recent cases, not to overtax the heart.

During the stage of compensation, treatment directed especially to the heart is rarely necessary. The main purpose should be to maintain the patient's general nutrition at the highest possible point during the period of active growth. To this end, diet, sleep, study, and exercise should receive the most careful attention. If malnutrition and anæmia are allowed to go on unchecked until they have become severe, the cardiac disease may make rapid strides, and as much harm be done in a few months as otherwise might not occur in years. The special symptoms of malnutrition and anæmia should be met as they arise, by the same means as when they occur under other conditions. The question of exercise and recreation is always a difficult one to settle. Often too little latitude is given, and the heart, like the voluntary muscles, loses its tone. Every form of exercise requiring a prolonged severe strain should be forbidden, particularly swimming and competitive games, like ball and tennis, and others requiring much running; but skating, rowing, mountain-climbing, horseback exercise, gymnastics, and even cycling on the level—all in moderation—may be allowed not only without harm, but with the greatest benefit; but any of these, used immoderately, may be productive of great injury. All exercise should be taken with regularity and system, the amount being carefully measured by the child's condition. If the patient

is a boy who must earn his
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heart.

Special watchfulness is r
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first symptoms of these con
the heart seems to be overta
should be so far as possibl
fresh attacks of rheumatism.
the winter and spring month

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present as in adults, and they
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Cardiac dropsy with low arte
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Disease of the muscular w
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usually the result of some in
furnish most of the cases are
important local cause is perica

Lesions.—In extra-uterine
of the left ventricle, the papill
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quently dilatation of the cavitie
the pericardium.

Two varieties of myocardit
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complete disintegration of the f
but it is usually diffuse. In th
in small, circumscribed areas.
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lead to the formation of larger or smaller areas of dense connective tissue resembling cicatrices, in the heart wall. Either the interstitial or the parenchymatous form may occur alone, but in most of the acute cases they are combined. In addition, there is usually some degree of mural endocarditis and inflammation of the pericardium next to the heart wall. Dilatation frequently follows; rarely abscesses may form, which may open into the heart or into the pericardium. Cardiac aneurism, and even rupture, have been known to occur in a child of six years (Hadden's case).

Symptoms.—These are very rarely sufficiently marked to enable one to make a positive diagnosis. In many cases in which advanced lesions have been found at autopsy there have been no symptoms during life, and in others none until the occurrence of sudden death. This is usually from cardiac paralysis, rarely from rupture. In eight cases studied by Romberg, which occurred in the course of diphtheria, not one had cardiac symptoms during life and two died suddenly. When symptoms are present, they are generally those of feeble heart action—a faint apex impulse, a slow, weak pulse of irregular rhythm, pallor, dyspnœa, and attacks of syncope. In the late stages there may be the physical signs of dilatation, with dropsy of the feet or the serous cavities, and scanty urine, sometimes containing albumin.

Diagnosis.—A positive diagnosis of myocarditis is impossible. It may be suspected in the course of diphtheria, scarlet or typhoid fever, when cardiac symptoms like those mentioned occur, and when pericarditis and endocarditis can be excluded by the physical examination.

Treatment.—This is mainly symptomatic. After severe attacks of those infectious diseases in which myocarditis is liable to occur, and at any time when it is suspected, patients should be kept recumbent for several weeks, and special care exercised to prevent any sudden exertion, as death has occurred from so slight a thing as suddenly sitting up in bed. Iron, alcohol, and tonics should be given, the best of all of these being strychnine. Digitalis should be used with caution, and never in large doses. In some cases with symptoms indicating imminent heart failure, more striking benefit follows the use of morphine hypodermically than any other plan of treatment.

ANÆMIC MURMURS.

As already stated, these are not uncommon even in infancy. They may be confounded with organic murmurs, either from congenital malformations or acquired disease. I have several times found the heart normal at autopsy in cases where a diagnosis of congenital disease had been unhesitatingly made during life, the murmur having been of anæmic origin. In any anæmic infant, as well as older child, one should hesitate to make a diagnosis either of congenital or acquired organic disease, from the mere presence of a murmur.

An anæmic murmur is u also in the carotids, often in any of the large trunks of th and sometimes it is altered may be loud enough to be h and even behind. There is There are no signs of hyper sound so characteristic of mi Anæmic murmurs diminish improvement in the general must wait for the effects of t

FUNCTIONAL

Disturbances in the hear are rare in infants and young are not uncommon, becoming One of the most important ca in schools, or anything else l cumstances it is usually asso turbances. An important pr the heart by the rapid grow particularly when this is asso there is a definite exciting ca it may be due to the excessiv the form of cigarette-smoking masturbation. It may follow malaria, or one of the exant course of these diseases, or wit

Symptoms.—The usual ma frequently there is tachycardia The majority of children cor than with organic disease, cer compensation. Attacks of pal form there is usually a sense with some dyspnœa, or even ort 120 to 130, and is irregular bot pulsate strongly. The apex in heart sounds are usually strong mur is heard. The face is pale tigo, spots before the eyes, and slight cyanosis with cold hands frequency of these attacks depe Their duration is from a few m

Diagnosis.—Functional disorders are differentiated from organic cardiac disease only by careful and repeated examinations of the heart. In the diagnosis of functional disturbance especial importance is to be attached to a neurotic or neurasthenic condition of the patient, to the presence of some adequate exciting cause, the absence of evidence of enlargement of the heart, and the fact that the pulmonic second sound is not increased.

Prognosis.—This in most cases is favourable, for with improvement in the patient's general condition, with the growth of the body, and in girls with the establishment of menstruation, the attacks usually disappear.

Treatment.—During the attacks, digitalis in moderate doses should be given, also bromides or valerian. The curative treatment is to be directed toward the cause. Where no special cause can be discovered a general tonic plan of treatment should be adopted, with careful regulation of the patient's diet, exercise, and mode of life. All stimulating food, tea, coffee, and tobacco should be prohibited. Anæmia should receive its appropriate remedies. The hours of sleep and study, and the amount and character of exercise allowed, should be carefully regulated. During the intervals no treatment of the heart is necessary.

DISEASES OF THE BLOOD-VESSELS.

Abnormally Small Arteries (*Arterial hypoplasia*).—This condition is not a very common one, but it has attracted a good deal of attention, having been studied especially by Virchow. The only thing which is abnormal in the circulatory system may be that the aorta, and sometimes all the large vessels are only two thirds or three fourths their usual calibre, or even less. This may interfere seriously with the growth and development of the body, especially of the genital organs, although this result is not a constant one. The condition is found occasionally in cases of chlorosis, and in the congenital cases it may be the chief cause. There is usually associated a certain amount of hypertrophy of the heart. The other symptoms are anæmia, and sometimes an imperfect development of the body. A positive diagnosis during life is impossible.

Aneurism and Atheroma.—In early life chronic disease of the blood-vessels is exceedingly rare, yet a sufficient number of observations have been recorded to show that even young children are not exempt from this form of disease. There had been reported up to 1890 twenty-eight cases of aneurism in patients under twenty years of age (Jacobi).* Of these, however, only twelve were under fourteen years. Sanné † records the youngest case, which occurred in a fœtus born at about the eighth month,

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* A. Jacobi, Archives of Pædiatrics, vol. vii, p. 161.

† Sanné, Revue Mensuelle des Maladies des l'Enfance, vol. v, p. 56. In these articles will be found references to most of the reported cases.

in whose body there was fou
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Embolism and Thrombosis.—
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large blood-vessels, particularly the pulmonary artery. Thrombosis occasionally occurs in all the large vascular trunks in childhood as well as in adult life.

Thrombosis of the internal jugular vein.—Pasteur [*] reports a case in a child two and a half years old, in which the middle of the vein was filled with an organized thrombus, and the lower portion obliterated and reduced to a fibrous cord. The symptoms were swelling, œdema, and cyanosis of the face, and dilatation of the facial vein, but not of the external jugular. There were clubbing of the fingers and œdema of the feet, but not of the arm. The heart was found to be dilated and hypertrophied, but was not the seat of valvular disease. The symptoms had existed since an attack of pneumonia, eighteen months before death.

Thrombosis of the vena cava.—Quite a number of cases are on record where this has occurred as the result of pressure from large abdominal tumours; it has followed new growths of the kidney and large masses of tuberculous lymph nodes. Neurutter and Salmon have recorded a case of thrombosis, apparently of marantic origin, in a child seven years old. The thrombus filled the vena cava, and extended to the origin of the hepatic veins and into both femorals. Death occurred from tuberculosis. In Scudder's case (seventeen years old) there was apparently obliteration (probably congenital) of the inferior vena cava; there was an extensive varicose condition of all the abdominal veins. The symptoms of thrombosis of the vena cava are swelling and œdema of the feet—sometimes of the abdominal walls and the groin—and very great dilatation of the superficial abdominal veins.

Thrombosis of the aorta.—A case has been reported by Leopold in a newly-born child which was delivered by version. The thrombus was of recent origin, and filled the lower aorta, extending into the femoral artery. A case of thrombosis of the aorta occurring in a girl of thirteen years has been reported by Wallis. The aorta was very narrow, and probably the seat of syphilitic disease. The thrombus extended from the origin of the renal arteries to the cœliac axis.

Thrombosis in infectious diseases.—There is occasionally seen in typhoid fever, but more frequently in diphtheria, thrombosis of some of the large venous trunks, usually of one of the lower extremities. The symptoms are pain, localized swelling, and partial paralysis. If the artery is affected, there may be gangrene.

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[*] Lancet, February 11, 1888.

DISEASES OF

THE URINE IN

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Schiff, and Herter:

Average Daily Quantity of Urine in Health.

AGE.	Grammes.	Ounces.
First twenty-four hours	0 to 60	0 to 2
Second twenty-four hours	10 " 90	⅓ " 3
Three to six days	90 " 250	3 " 8
Seven days to two months	150 " 400	5 " 13
Two to six months	210 " 500	7 " 16
Six months to two years	250 " 600	8 " 20
Two to five years	500 " 800	16 " 26
Five to eight years	600 " 1,200	20 " 40
Eight to fourteen years	1,000 " 1,500	32 " 48

Frequency of Micturition.—This is greatest in young infants, and diminishes steadily as age advances. In the first two years, during the waking hours, the urine is generally passed as often as twice an hour, while during sleep it is retained from two to six hours. By the third year the urine may be held during sleep for eight or nine hours, and at other times for two or three hours. Such control of the sphincter of the bladder is often obtained at two years, and sometimes even at an earlier period. From slight nervous disturbances or minor ailments of any kind, this control is impaired, and the water may be passed by children of four or five years with the frequency seen in infants.

Physical Characters.—The urine of the newly born is usually highly coloured. During later infancy it is pale and frequently turbid, even when practically normal, owing to the presence of mucus; this turbidity often no amount of filtration will entirely remove. Less frequently turbidity depends upon urates. The urine of the first few days of life often shows a deposit of urates or uric acid in the form of a reddish-yellow stain upon the napkin. The reaction of the urine at this time is usually strongly acid, but throughout the rest of infancy it is faintly acid or neutral.

The specific gravity is higher during the first two days than at any time in infancy on account of the scanty supply of fluid taken; it is usually lowest from the third to the sixth day, but from this time it rises steadily until puberty is reached. The specific gravity will of course vary with the quantity. From the writers already referred to the following figures are taken:

	Specific gravity.
First to third day	1·010 to 1·012
Fourth to tenth day	1·004 " 1·008
Tenth day to sixth month	1·004 " 1·010
Six months to two years	1·006 " 1·012
Two to eight years	1·008 " 1·016
Eight to fourteen years	1·012 " 1·020

Microscopically, the urine of the newly born shows the presence of many squamous epithelial cells, mucus, granular matter, and crystals of uric acid and amorphous or crystalline urates. It is not uncommon to find hyaline and even granular casts. Martin-Ruge found hyaline casts in the urine of fourteen out of twenty-four healthy nursing infants examined during the first week. Granular casts were much less frequent. The microscopical appearances of the normal urine of later infancy and childhood present no peculiarities.

Composition.—*Urea.*—The following figures show the average daily quantity of urea eliminated at the different ages:

Age.	Daily quantity of urea.
First day	0·076 to 0·114 gramme.
Second to seventh day	0·140 " 0·660 "
One to two months	0·90 " 1·40 "
Three to five years	13·09 " 14·01 grammes.
Five to thirteen years	16·05 " 21·03 "

Uric acid.—Few observations have been made upon the elimination of uric acid, but all authorities agree that it is much higher in the newly born than at any subsequent period of life. The quantity is better appreciated by giving the ratio between the uric acid and urea than by the absolute quantity of the former. The figures here given for the newly born are taken from Martin-Ruge; the others are from Herter.

Ratio of Uric Acid to Urea.

In the newly born	1 to 14
Under one year	1 " 60–80
From two to five years	1 " 50–70
From five to fifteen years	1 " 45–60

The inorganic salts (phosphates, chlorides, sulphates) are all present in the urine of the newly born, but in relatively small quantity, increasing as age advances. The colouring matters are also less abundant.

Albumin is often present in the urine during the first days, but usually in small amount. Cruse found it twenty-eight times in ninety observations upon healthy infants; usually the quantity was small, amounting to traces only, but in two cases it was quite large upon the second day. These observations are confirmed by the investigations of Martin-Ruge, and also of Pollak.

Sugar is frequently found in the urine of healthy infants during the first two months. This subject is referred to later under the head of Glycosuria.

FUNCTIONAL OR CYCLIC ALBUMINURIA.

Etiology.—This condition, although a rare one in young children, is quite common between the ages of ten and sixteen years. I shall not in this connection include cases sometimes classed as febrile albuminuria, in which there is usually present the condition described as acute degeneration of the kidneys.

The causes of functional or physiological albuminuria, and the circumstances in which it has been observed, are many and varied. It is much more common in males than in females. In many patients it is regularly cyclic in character, albumin being absent in the urine passed during the night or early morning, but present during the day, diminishing in the evening and absent at bed-time. In a case reported by Tiemann, the morning urine showed no trace of albumin in seventy-eight of eighty-four examinations. At noon albumin was present in ninety-eight of one hundred and thirteen examinations. In certain cases albuminuria is distinctly traceable to cold bathing; in others, to fatigue following excessive muscular exercise; in still others, to dyspeptic conditions. It may be associated with a diet rich in nitrogenous food. In other cases none of these conditions exist, and there is simply the occasional presence of albumin in the urine.

Many theories have been advanced in explanation of cyclic albuminuria. Sometimes it appears to be clearly traceable to irritation of the kidney by uric acid, urates, or oxalates. Kinnicutt believes this to be one of the prominent causes, and that albuminuria is due to vaso-motor disturbances in the kidney. Delafield compares the exudation of serum from the vessels of the kidney to the dropsy of the feet seen in anæmia. Da Costa believes that it always depends upon slight changes of an evanescent character in the kidney.

Symptoms.—Many of the patients exhibiting cyclic or periodical albuminuria are well nourished, and have no other signs of disease; others show dyspeptic symptoms, and are anæmic and poorly nourished, suffering from headaches and other neuroses. In the cases distinctly periodical the amount of albumin is commonly small. It is not infrequently associated with temporary glycosuria. As a rule, casts are absent, although it is not uncommon to find a few hyaline casts, and occasionally granular casts are also present. A gouty family history exists in a certain proportion of the cases, and some of the patients themselves present other evidences of this diathesis.

Diagnosis.—Pavy mentions the following points as characteristic of physiological or functional albuminuria: (1) The time of its occurrence. The absence of albumin early in the morning, its presence in the forenoon, and diminution toward evening. When this is repeated day after day the diagnosis is, he believes, quite positive. (2) The absence of serious impairment of the general health and of the characteristic symptoms of nephritis, such as dropsy, cardiac hypertrophy, a pulse of high tension, retinal changes, etc. (3) The fact that casts are, as a rule, absent. (4) That crystals of oxalate of lime are present, and the urine is of high specific gravity.

Too much stress is certainly laid by Pavy and many other writers upon the fact that the albumin is found in the urine only at certain

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Treatment.—This is to be
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ones from the ureter, are conclusive evidence of the renal origin of the hæmorrhage.

In children, renal hæmorrhage in itself rarely requires treatment; when it does, the same remedies are indicated as in the adult, viz., ergot, gallic acid, and rest in bed. Some obstinate cases have been cured by drinking water from alum springs.

HÆMOGLOBINURIA.

In this condition blood pigment appears in the urine in large quantity, but red blood-cells are very few in number, or are absent altogether. In severe cases the urine may be almost black. There is commonly a small amount of albumin. This condition may be recognised by the appearance of granules of pigment under the microscope, or by Heller's test; the most conclusive means of diagnosis, however, is the spectroscope.

Epidemic hæmoglobinuria (Winckel's disease) has already been described in the chapter on Diseases of the Newly Born. Hæmoglobinuria may be due to certain poisons, as carbolic acid or chlorate of potash, or to certain infectious diseases, as scarlet fever, typhoid fever, malaria, syphilis, and erysipelas.

Paroxysmal hæmoglobinuria occurs in childhood, although it is an exceedingly rare condition. A typical case in a child of four and a half years has been reported by Mackenzie. This was a delicate child of syphilitic parents; the hæmoglobinuria was preceded by fever and chills, without any other evidence of the presence of malaria.

The exact pathology of hæmoglobinuria is at present unknown, and its treatment is very unsatisfactory.

GLYCOSURIA.

By this term is understood the occasional or transient appearance of sugar in the urine. This is not very infrequent in children, and may be met with even during the first month of life. Grósz has published some careful investigations upon the glycosuria of early infancy.* He made many observations upon fifty infants during the first month of life, from which the following conclusions were drawn: Glycosuria is not uncommon in nursing infants; but it is not seen in nursing infants who are perfectly healthy. It occurs particularly with certain disturbances of digestion, whether functional or inflammatory. The sugar found in the urine under these conditions reacts strongly to the reduction test (Fehling's), but not to the fermentation test; sometimes the polariscope shows that it has the power of dextro-rotation. This is believed to be milk sugar, or one of its derivatives. It is not of constant or regular occurrence. It may be

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* Jahrbuch für Kinderheilkunde, Bd. xxxiv, p. 83.

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The treatment of pyuria dep
ment in the symptoms sometime

zoate of ammonia in doses of from two to five grains every three hours to a child of five years. It is especially indicated where the urine is strongly alkaline.

LITHURIA.

Lithuria is a condition in which there is an excessive elimination in the urine of uric acid or of urates. The amount of nitrogen compounds eliminated by the kidneys as uric acid and urea, varies much from day to day with the nature of the food and other conditions. Hence in estimating an excess of uric acid, the absolute quantity eliminated in twenty-four hours is much less significant than the ratio of the uric acid to the urea (page 596). Whenever this ratio is continuously disturbed, the excretion of uric acid may be considered abnormal, except, of course, in grave pathological conditions of the kidney, where there is an insufficient elimination of urea. Regarding the source of uric acid, the theory of Horbaczewski is that most widely accepted, viz., that it results from the destruction of the nuclein of the cells of the body, particularly of the white blood-cells.

For accurate knowledge as to the amount of uric acid eliminated, nothing short of a quantitative chemical analysis can be depended upon. But if amorphous urates are deposited in large amount, uric acid may be considered excessive if the specific gravity is not high (above 1.025). If the specific gravity is high, the precipitation may be explained simply by the concentration of the urine. The deposition of the crystals of uric acid, forming the familiar brick-dust deposit, is not evidence of excessive elimination. For a quantitative clinical test, that of Haycroft is probably the best.*

Lithuria is not a specific condition, but rather a very general symptom associated with many kinds of disturbances of nutrition. It may be found in anæmia, malnutrition, chorea, rheumatism, chronic dyspepsia, and in a great variety of other disorders. Regarding the significance of lithuria, thus much may be positively asserted: The excessive elimination of uric acid when continuous is always evidence of a serious disturbance of nutrition. The gravity of the condition will depend upon the degree of this excess and upon its duration.

The treatment of lithuria is the treatment of the condition upon which it depends. The essential pathological condition is not so much excessive elimination as excessive production.

Urine containing Crystals of Uric Acid in the Form of Brick-Dust Deposit.—This condition is not to be confounded with the one just described. As already stated, such precipitation is not to be taken as evidence of an excess of uric acid, and, in fact, in most of these cases there

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* See Haig on Uric Acid in Health and Disease.

is no excess. The conditio
the urine for uric acid is m
coloured, strongly acid, and
This condition also is de
one which is most frequentl
very common in children exc
patients it is only occasionall
other disturbance of nutritic
cause of local irritation of the
which may be severe.

In my experience these ca
from the diet almost entirely,
food and substituting a diet
and cream, together with ple
of alkaline waters is also of de

I

Indicanuria is a condition
the urine. To Herter is due
nently to the minds of the pro
potassium sulphate) is derived
tine by the agency of bacter
proteids. It may also be produ
factive processes are going on,
age, in pulmonary cavities, e
ethereal sulphates produced i
other conditions like those me
index of the amount of putrefa
The presence of indican in t
oxidizing agents, which produ

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* The commonly employed test
described by Herter as follows: Po
strong hydrochloric acid so as to fill
shake. If there is much indican, a d
add sufficient chloroform to comple
important that the chloroform shou
get in by the agitation. If, after sta
let colour, there is certainly an exce
first, but may come out after standi
crease in intensity. Sometimes, whe
adding one drop of a saturated solu
gen. No more than one drop should
bleached. In alkaline urine the indic
negative.

of indicanuria in children was formerly believed to be pathognomonic of tuberculosis. Later investigations have shown that this is not the case; for in cases of tuberculosis indican is almost as frequently absent as present.

Herter gives the following as the conditions under which indicanuria is likely to be present: It is found in chronic intestinal indigestion; in very many cases of chronic constipation; in many cases of epilepsy, just about the time of the seizures; in some cases of masturbation; frequently in children who are the subjects of night terrors, and in whom there are usually disturbances of digestion. According to other observers, it is found with great constancy in acute putrefactive diarrhœas. With the exceptions above noted, the source of the indican is always the same, viz., the excessive putrefaction of the proteid substances in the intestine.

Indicanuria is most frequently a symptom either of acute or chronic intestinal disease. It is important as being a guide by which we may estimate the other symptoms in these conditions, and the effects of treatment. While a trace of indican is frequently present in health, a strong indican reaction is always to be considered abnormal in a child. The indications for treatment are to diminish intestinal putrefaction. This is mainly dietetic, and is to be accomplished by means referred to in the treatment of chronic intestinal indigestion (page 368).

ACETONURIA—DIACETONURIA.

Acetone exists in small quantities in the urine of healthy children. According to Baginsky and Schrach, it is found in large quantities in many febrile diseases. It increases with the height of the fever and subsides with it. Acetone is probably formed from the destruction of the nitrogenous material of the body, as it is increased by a nitrogenous diet, and may disappear by a diet of carbohydrates. Baginsky found it also in children with epilepsy, sometimes during the attacks. It is not, however, believed to be the cause of the convulsive seizures, as it is absent in convulsions occurring under other conditions. It has no relation to rickets. According to Schrach, there is no connection between acetonuria and the nervous symptoms accompanying fever. Von Jaksch found acetone in a case of diabetic coma.

Binet found *diacetic acid* in sixty-nine out of one hundred and fifty examinations in febrile diseases, chiefly in scarlet fever, measles, and pneumonia. In diabetes this condition often precedes the development of coma, otherwise it is of no prognostic significance. Schrach found diacetonuria exceedingly common in all cases of continuous high fever. It is more frequently present than acetonuria, and ceases with the fever.*

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* For literature, see Baginsky, Archiv für Kinderheilkunde, Bd. xi, p. 1.

By this term is meant an
which occurs in the course of
erally applied. Anuria is to
from the scanty secretion wh
held on account of illness, a
diarrhœa with large, watery
newly born, where it depend
tract; or it may depend upon
first urine passed after such
may contain an abundance
to the naked eye. Other ca
condition must be regarded
secretion appears to be comp
pation and catheterization, is
very uncommon one in infan
thirty-six hours. So long as
every other respect, the susp
twenty-four hours need excite

The treatment is very sim
istration of sweet spirits of nit
acetate or citrate of potash, a
months one minim of the nitre
be given every hour in half an
is established, which will usual
very highly acid, and stains the
for several days. Hot foment
advantage.

DIABETES I

This is a chronic disease ch
amount of pale urine of low spe
by polydipsia. The disease is a

The exact pathology of diab
conditions under which it occ
irritation which gives rise to it
ventricle, or it may affect the re

Etiology.—Of eighty-five ca
under ten years of age and nin
of seventy cases, the disease be
in seven during infancy. In so
are more frequently affected tha
an important factor. Weil has

disease existing in many members of a single family. Falls or blows upon the head, concussion of the brain, tumours of the brain, especially of the occipital region, tuberculous or cerebro-spinal meningitis or chronic hydrocephalus, all have been found associated with diabetes insipidus. It sometimes has followed the acute infectious diseases; but in many cases no cause whatever can be found.

Symptoms.—The quantity of urine is enormous, usually exceeding even that in diabetes mellitus. From five to twenty pints daily may be passed. The urine is pale, the specific gravity from 1·001 to 1·006, and it contains neither albumin nor grape sugar. In a few cases the presence of inosite (muscle sugar) has been found. Restricting the amount of fluid taken causes a very marked diminution in the amount of urine. The intense thirst leads patients to drink enormously of water and other fluids. Various contradictory statements are made by different writers regarding the quantity of uric acid and urea eliminated in these cases. The following are the results obtained in a case recently under observation in the Babies' Hospital.* The child was three years old, quite anæmic, and losing in weight. On January 20th the fluids were unrestricted, on the other days they were restricted:

DATE.	Daily quantity of urine.		Specific gravity.	Total urea.	Total uric acid.	Indican reaction.	Inosite.
	Grammes.	Ounces.		Grammes.	Grammes.		
January 20	3,300	101½	1·006	22·276	0·173	None.	None.
" 25	750	25	1·010	9·049	0·072	Strong.	None.
" 26	775	25¼	1·010	6·478	......	....	None.
February 8	1,320	49	1·007	12·113	0·110	None.	None.

The elimination of urea in this case is excessive, but the uric acid is not far from the normal.

Nervous symptoms are usually present. There may be disturbed sleep from the frequent micturition, palpitation, flushing of the face and other vaso-motor disturbances, headache, restlessness, and neuralgia. There may be incontinence of urine. The skin is pale and dry, and perspiration is scanty. The general health may not be disturbed. In most cases, however, it is somewhat affected, and there may be the usual symptoms of malnutrition, and even neurasthenia. If it affects young children, their growth may be considerably retarded. The appetite usually remains quite good. The temperature is at times slightly subnormal. The course of the disease is indefinite. It is very chronic, and may last for many years, death taking place only from intercurrent affections.

Prognosis.—A few of the cases recover spontaneously. Those of short duration are often cured by treatment. Of the chronic cases in which the disease is well established very few are controlled. The prognosis is worse if there are marked disturbances of the digestive tract or organic brain disease.

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* The analyses were made by Dr. C. A. Herter.

Diagnosis.—This is easily made from the two marked symptoms, excessive thirst and the polyuria. From diabetes mellitus it is easily distinguished by the low specific gravity and the absence of sugar from the urine. In older children, chronic nephritis with contracted kidney may be confounded with it.

Treatment.—Fluids should be moderately restricted. It is a serious mistake to reduce the quantity of fluids too much, since the drinking is not the cause of the diuresis. The diet should be simple and nutritious, consisting largely of meat, with a moderate amount of carbohydrates. The general treatment should be directed to the condition of malnutrition. The clothing should be warm, and a moderate amount of exercise should be allowed. Drugs are of little use; those which have sometimes been beneficial are arsenic, belladonna, ergotine, the bromides, and antipyrine. Treatment must be continued for many months to be of any value.

CHAPTER II.

DISEASES OF THE KIDNEYS.

MALFORMATIONS AND MALPOSITIONS.

MALFORMATIONS of the kidney are not infrequent. In seven hundred and twenty-six consecutive autopsies at the New York Infant Asylum malformations of the kidney or ureters were met with in seventeen cases. This does not represent the actual frequency with which they occur, for in about half the number of autopsies in two other institutions only a single example was seen. Adding to the cases mentioned two others seen elsewhere, there are twenty cases of renal malformation of which I have notes, classed as follows:

Fusion of the kidneys, or horseshoe kidney	4 cases.
Supernumerary ureters	4 "
Hydronephrosis (alone)	8 "
Cystic degeneration of the kidney (alone)	2 "
Hydronephrosis and cystic kidney	1 case.
Single kidney	1 "

In all malformations the left kidney is much more frequently affected than the right, the proportion being nearly two to one. Malformations are more often seen in males than in females.

Fusion of the Kidneys.—In one case, in a child who died of pneumonia at the age of three years, the kidneys were fused into one irregular ovoid mass, lying upon the lumbar vertebræ; in another case the mass lay upon the promontory of the sacrum; in both there were two renal arteries and two ureters. In the two other cases the organs were united at their lower extremities, and in both of these there were two ureters passing in front of the kidney. In one there was also hydronephrosis and chronic diffuse nephritis. The children died at the ages of four and five months respectively.

Cystic Degeneration of the Kidneys.—In two of these three cases the right kidney was affected, and in one the left. The ages at which the children died were from seven to ten months. No renal symptoms were present. In all the cases the cystic kidney was very small, about an inch and a half in length and one inch in width. The organ was entirely made up of smaller and larger cysts containing a clear fluid, held together by loose connective tissue. The ureter was small and rarely pervious throughout. In one case there was hydronephrosis of the opposite side; in the others the opposite kidney was considerably enlarged, being about one half larger than normal. In addition to these small cystic kidneys there has been described a cystic degeneration in which very large cysts have formed even *in utero*, sometimes filling the abdominal cavity of the child and seriously interfering with delivery.

Single Kidney, the other being rudimentary or absent.—Of this I have seen but one example, which was found in a young man twenty-two years of age, who died of typhus fever in Bellevue Hospital. The right kidney weighed seven and a half ounces; the left was represented by a nodular mass about the size of an ovary, showing no trace of renal tissue. The ureter was pervious to within four inches of the kidney; the suprarenal capsule was normal. Macdonald has reported a case in which there was no trace whatever of the right kidney; the left was greatly enlarged, and weighed nine ounces. There were two suprarenal capsules but only one ureter. Schaeffer has reported absence of both kidneys in a seven-months' fœtus, associated with many other malformations.

Hydronephrosis.—Of the ten cases of which I have notes, this existed as the principal deformity in eight. In two cases it was associated respectively with cystic degeneration of the opposite kidney and horseshoe kidney. In seven cases only the left side was affected; in three there was double hydronephrosis. Seven patients were males and three females. Six died before they were six months old, and only two lived to be two years old. This condition is undoubtedly the result of some obstruction to the outflow of urine in the ureter, bladder, urethra, or prepuce, but in only three of my cases could there be found an obstruction sufficient to explain the deformity. In two there was marked hypertrophy of the bladder. In no case was a calculus found as the cause of the obstruction. In most of the cases the ureter was dilated to a diameter of from one

fourth to one half of an inc
mistaken for the small intesti
gated and sacculated; the pe
of half an ounce or more, the
diameter. Less frequently t
leaving only a series of comm
of renal tissue from one four
five cases there was chronic
sometimes both kidneys wer
was unilateral. The nephrit
two cases, typical examples of
seen, one of these children d
are shown in Fig. 105. In t
very marked hypertrophy.

Urinary symptoms were n
due to pyelo-nephritis depend
not the seat of hydronephrosis.
pected during life. Four pati
pneumonia, and one of ileo-co
tion outside the urinary tract,

Double hydronephrosis is
changes in the kidneys that t
in the first year. At this age
ognised only by the changes i
nephritis. There may be the
fuse nephritis, or, when infec
added the symptoms of pyelitis
dition is unrecognised, the pati
itself fatal, but rendered so by

If hydronephrosis is unilat

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* This was in every way a remar
mus. There was double hydronephr
diameter. The right kidney was n
capsule. Just beneath the capsule
kidney was the seat of hydronephros
sixth of an inch in thickness. Micro
the capsule of the right kidney, an
just beneath the capsule. The rest
fibrous tissue in which were scatte
which was clear, nucleated, and of t
of chronic diffuse nephritis of the a
medullary portions. The cortex show
normal in thickness. The small size
pyramids. The walls of the bladder
fourth of an inch thick. The urethra

dilatation of the pelvis of the kidney has reached a sufficient size to form an abdominal tumour. In most of the cases in children this condition has been noted between the third and the eleventh years. This tumour may be situated in the lumbar region, or it may fill the abdomen. It is cystic, and may be confounded with a dermoid cyst of the ovary. On aspiration a fluid is withdrawn which may be clear, or of a brownish colour, and recognised as urine by the fact that it contains urates and urea. After aspiration the urine passed *per urethram* may be bloody. Aspiration affords only temporary relief, as the tumour quickly refills. If an incision is made and the kidney drained, a cure may result with the formation of a fistula. This may continue indefinitely, or infection of the fistulous tract may occur and suppurative nephritis be set up, which

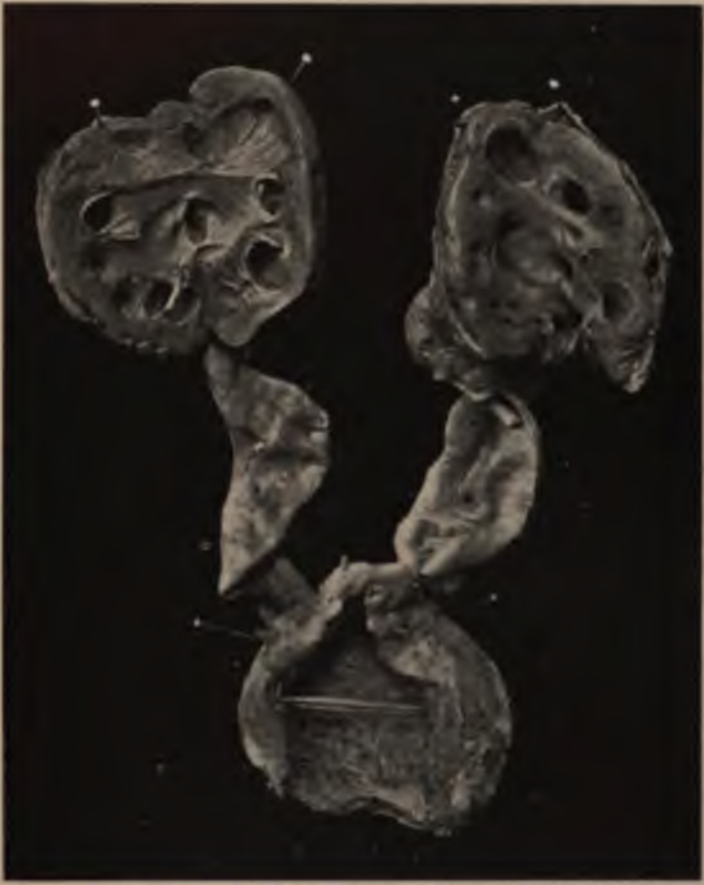

FIG. 105.—Congenital hydronephrosis, dilated ureters, and hypertrophied bladder. (From a child one month old.)

speedily carries off the patie
may result in a permanent
is usually the case if the chi
above stated, viz., that a chil
dies in infancy. Whether
or not, will depend much u
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Supernumerary Ureters.—
quently on the left side. Th
given off, one from the upper
each ureter having a separate
the bladder, or entered this
is of no practical importance
renal changes.

Malposition of the Kidney.
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kidney only; the left being
Northrup has reported two ca
in one, the organ lay in the
median line, partly above and
Malpositions of the kidney a
velopment. In most of the ca

Movable or Floating Kidne
mal conditions seen in this org
reported by Phillips, Korsako
those seen in adult life.

URIC-A

These consist in a deposit
acid or of amorphous or cryst
fected, and all the pyramids o
the naked eye as fine, brownish
there may be granular deposits
and sometimes evidences of cat
even the presence of blood. T
gree at least, in nearly all infan
formerly supposed that the dis
an infant had breathed, and a c
fore attached to them. This is
sometimes found in still-born in

The cause of this condition

sufficient water to dissolve it, so that the crystals are deposited in the tubes. Uric-acid infarctions are found chiefly in children dying before the end of the second week, although it is not uncommon to see them as late as the third or fourth or even the sixth month. In most of the cases, as the urinary secretion becomes more abundant, the deposits are washed out in the urine and appear as brownish-red stains upon the napkins. Infarctions may give rise to a slight inflammation of the renal tubules, but very rarely to any serious lesion; sometimes they remain as deposits in the calices or the pelvis of the kidney or in the bladder, forming the nucleus of a calculus. The symptoms to which they give rise are mainly scanty urination during the first week of life, and occasionally anuria for the first day or two. Sometimes there is evidence of pain on micturition, and there is the stain upon the napkin already referred to. The treatment is to give water freely and some alkaline diuretic such as citrate of potash. One grain should be given every two hours until the secretion is fully established; this in most cases will be within twenty-four hours.

ACUTE CONGESTION OF THE KIDNEY.

In acute congestion of the kidney all its blood-vessels contain much more blood than normal, and from them there may be an escape of serum and even of the red blood-cells by diapedesis. This congestion may result from traumatism, the ingestion of certain poisons, from any of the infectious diseases, or from cold.

The urine is usually scanty, of high specific gravity, and contains albumin and red blood-cells, sometimes blood casts. This may be only a temporary condition passing off in a few days without further symptoms, or it may exist as the first stage of acute nephritis. It is most serious when it occurs in kidneys already the seat of serious disease. There are sometimes no symptoms except those of the urine; or there may be headache, pain in the back, and some general indisposition.

The treatment consists in free catharsis, the use of hot vapour baths, and counter-irritation over the kidneys by means of hot poultices or dry cups.

CHRONIC CONGESTION OF THE KIDNEY.

This results from interference with the return circulation of the kidney, and may be caused by congenital malformation or valvular disease of the heart, chronic broncho-pneumonia or chronic pleurisy; also by the pressure of any abdominal tumour upon the inferior vena cava or the renal veins.

The kidneys are generally enlarged, firmer than normal, and dark-coloured. All the capillary vessels are swollen and distended with blood, and their walls are thickened. In addition to the symptoms of the primary disease, the amount of urine passed is usually scanty and of high specific gravity. Albumin and casts are generally present, but are not constant. The treatment should be directed toward the primary condition, and, in addition, an effort should be made to increase the urine by alkaline diuretics, caffein, digitalis, and the sweet spirits of nitre.

ACUTE DEGENERATION OF THE KIDNEYS.

In the succeeding pages devoted to diseases of the kidney I shall follow the classification of Delafield, which seems to me the simplest and most exact that has yet been proposed. For the description of the lesions I am indebted largely to his Lectures.

In acute degeneration of the kidney the principal or only change is in the epithelium of the tubules. It is exceedingly common both in infancy and in childhood, being found to a greater or less degree in all autopsies upon patients dying of acute infectious diseases, but it is most marked in cases of scarlet fever, diphtheria, and acute pleuro-pneumonia. It may be found in any disease characterized by prolonged high temperature; and it is the explanation of the cases of so-called febrile albuminuria. The cause is in all probability direct irritation of the epithelium of the tubules by the toxines eliminated by the kidneys. It may also be induced by irritating drugs, such as cantharides or turpentine. By some writers these cases have been classed as examples of acute nephritis; hence the great discrepancy which exists in statements made as to the frequency of nephritis in the different infectious diseases.

The kidneys are usually slightly enlarged, and paler than normal. On section the cortex may be somewhat thickened, and the straight tubules marked by yellowish-gray lines. It is the appearance commonly spoken of as "cloudy swelling." The organs are seldom much congested. The microscope shows a granular degeneration and death of the epithelium of the tubules, and when severe this may be accompanied by congestion and the exudation of serum.

Acute degeneration of the kidneys gives rise to no symptoms in addition to those of the original disease, except the appearance of a moderate amount of albumin in the urine, and sometimes a few hyaline or granular casts. It can not be said that such a condition adds much to the danger of the original disease. In cases that recover, the condition of the kidney entirely clears up. The development of the symptoms of degeneration of the kidneys in infectious diseases calls for no special treatment beyond a continuance of the fluid diet.

ACUTE EXUDATIVE NEPHRITIS.

Synonyms: Acute parenchymatous nephritis, acute desquamative nephritis, acute septic interstitial nephritis.

Etiology.—This variety of nephritis occurs apparently as a primary disease both in infants and in older children. Most such cases are undoubtedly of infectious origin, although the point of entrance of the infection it may be difficult or impossible to determine. This form of inflammation is much more frequently secondary to the acute infectious diseases, especially to scarlet fever and diphtheria. It occasionally follows measles, varicella, empyema, typhoid fever, acute diarrhœal diseases, pneumonia, meningitis, influenza, and, in rare instances, eczema. This is the characteristic variety of secondary nephritis occurring in septic conditions. The exciting cause of the inflammation is in some cases the irritation from toxines; in others there is in addition the entrance of pyogenic germs, carried by the circulation.

Lesions.—This inflammation is characterized by congestion and exudation of the blood plasma with leucocytes and red blood-cells, also by changes in the renal epithelium and the glomeruli. In infants and young children the predominant feature of the lesion is usually the exudation of leucocytes. In severe cases the kidneys are enlarged, and usually soft and œdematous. The cortex, which is the seat of the most marked changes, is thickened and of a uniform yellowish-white colour, or it may be mottled with red, owing to small hæmorrhages. Sometimes there is congestion of the entire organ. At other times, both on the surface and on section, the kidney presents a mottled yellow appearance, these yellow spots being aggregations of pus cells; they are scattered through the organ, and vary in size from a pin's head to a pea. Minute abscesses may even be found. The microscope shows the renal epithelium of the tubules to be swollen, loosened, and degenerated. The tubules may be dilated, and contain red and white blood-cells and degenerated epithelium. The glomerular changes are often marked. There are swelling and proliferation of the cells covering the capillary tufts, and similar changes in the capillaries themselves. There may be red or white blood-cells in the cavities of the capsules, and cocci may be found in the small blood-vessels. There are accumulations of leucocytes in the tubes, in the stroma, and in the venous capillaries. These cells are usually in irregular patches. The excessive emigration of leucocytes may not be accompanied by blood serum, and hence there may be no albumin in the urine.

I have made autopsies upon six cases of nephritis of this variety in young infants, which were apparently primary. In all these cases the excessive exudation of leucocytes was the striking feature of the disease.

Under the microscope they
renal elements.

Symptoms.—1. *Primary*
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uniformly fatal, chiefly on accou

2. *Primary form in older ch*

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* Archives of Pædiatric

disease. As compared with the same condition in infants, the onset is usually less abrupt, the febrile symptoms are less marked, and the termination is less frequently fatal. There is little dropsy, often none at all. The urine is only slightly diminished in quantity; the amount of albumin is small; casts are not numerous, and usually hyaline, epithelial, or granular; very rarely is there much blood present. Uræmia is very infrequent, and the prognosis is much more favourable than in infancy.

3. *Secondary form.*—This is the most common variety of secondary nephritis of infectious diseases. It usually occurs at the height of the febrile process, and its severity is generally proportionate to the intensity of the infection. The constitutional symptoms are often not marked, and dropsy is rare. Unless the urine is examined the condition may be overlooked. The urinary changes are essentially the same as those already mentioned in the primary cases. While the involvement of the kidneys adds to the danger of the primary disease, it is rare that the nephritis is itself the cause of death. Suppression of urine and the development of the symptoms of acute uræmia are infrequent.

ACUTE DIFFUSE NEPHRITIS.

Synonyms: Acute Bright's disease, glomerulo-nephritis.

This is a more severe form of inflammation than is exudative nephritis, and is much more likely to be followed by permanent damage to the kidney.

Etiology.—Acute diffuse nephritis occasionally occurs in children apparently as a primary disease, its origin being then obscure. It is usually attributed to cold and exposure, and certainly this is sometimes the case. It is the secondary form which is especially important in early life, and in the great majority of cases this follows scarlet fever. It is the characteristic post-scarlatinal nephritis. Occasionally, however, it follows diphtheria, and may indeed occur after any severe form of infectious disease. The cause in the scarlet-fever cases is now generally admitted to be the poison of the primary disease—probably the result of direct irritation from toxines. While it may sometimes follow a definite exposure, as when patients have been allowed to get up or go out too soon, it occurs also in those who have been kept in bed throughout the attack; sometimes even in mild cases. But there is little doubt that exposure may precipitate an attack in a patient who might otherwise have escaped. An important etiological factor is the too early use of solid food. The frequency of nephritis as a sequel of scarlet fever varies much in different epidemics; in some it is rarely seen, while in others it may occur in nearly half the cases; the average is probably from six to ten per cent. While it most frequently follows a severe form of scarlet fever, it may occur after an attack which has been so mild as to escape notice until the appearance of

desquamation. Season appe
frequency.

Lesions.— In this form of
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Symptoms.—When the dise
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come from the convoluted tubes,
as of grave significance, indica

involved. Red blood-cells are present in great numbers; also many leucocytes, and always a large amount of renal epithelium.

The duration of the active symptoms in cases terminating in recovery is from one to three weeks. The temperature and dropsy gradually subside. Improvement in the urine is shown by an increase in quantity, by increased elimination of urea, and by a diminution in the amount of blood, albumin, and the number of casts. A few casts may persist for several weeks, and a small amount of albumin for two or three months.

In the graver cases, where the onset is accompanied by high temperature, pain in the back and loins, and a rapid, full pulse of high tension, the urine is very scanty and is often suppressed. Then follow the symptoms of uræmia. In children this is usually manifested by vomiting, great restlessness or apathy, and often by diarrhœa. Less frequently there are headache, dimness of vision, stupor developing into coma, or convulsions. If the secretion of urine is re-established, the nervous symptoms abate and the patient may recover. This has been known to occur after complete suppression has lasted thirty-six hours. Care should be taken not to mistake retention for suppression. If doubt exists, percussion of the bladder and the use of the catheter will quickly settle the question.

There are several complications for which the physician must constantly be on the lookout during attacks of acute nephritis; the most frequent are pneumonia, pleurisy, pericarditis, and endocarditis; more rarely there may be meningitis and œdema of the glottis. It is from complications or acute uræmia that death usually occurs.

Prognosis.—This is to be considered from two points of view: first, the danger to life during the acute stage of the disease, and, secondly, the danger of the development of chronic nephritis. The great majority of patients survive the acute stage, and not infrequently even those recover who have presented grave symptoms of uræmic poisoning. The quantity and specific gravity of the urine, and the number and variety of the casts, are a much better guide in prognosis than the amount of albumin. The existence of severe nervous symptoms, such as stupor, intense headache, dimness of vision, and persistent vomiting, add much to the gravity of the case, as does also the presence of any serious complication. In general it may be said that if there is no suppression of urine, or if there are no symptoms of uræmia and no complications, recovery is almost certain if the child is over three years old; in younger children the outlook is less favourable. The general opinion prevails that acute diffuse nephritis in childhood, whether it is primary or occurs as a complication of scarlet fever, is rarely followed by the chronic form of the disease; and such was the view I formerly held. Larger experience, however, has convinced me that this sequel is not very uncommon. The interval of apparent health may sometimes cover a period of several years, and the later nephritis may be attributed to other causes; but all cases of severe scarlatinal ne-

phritis should be carefully wa
attack a guarded prognosis sho
result.*

Treatment of Acute Nephrit
principally to the secondary for
diseases, especially post-scarlati
lined apply equally to all variet
in most of these cases the resul
are eliminated by them, it follo
intestines should be increased,
little irritating as possible by
indication is met by frequent
bowels freely opened by saline
one or two loose movements d
patient should be kept upon a
the three weeks of the disease,
same time he should drink ve
plain water to which a small d
diuretic like the citrate of potas
borne, kumyss, whey, buttermil
mixed with milk. When the f
this plan of treatment should in
measures, after an attack of scar
for at least a week after the tem

The mild cases of acute nep
the hygienic and dietetic treatm
the drinking of large quantities
the skin and bowels. These
the urine contains any considera
patient's general condition will
or lose much in weight, it may
addition of solid food. This sh
usually in the form of some fa
and exercise should be made
urine carefully watched.

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* The following case may be cited
of seven years had scarlet fever, foll
was reported, for three months. She
remained in apparent health until sh
severe chilling, she developed dropsy a
that time, although she lived for thr
seemingly in the best of health, her uri
she finally died in uræmic convulsions.

† See W. H. Flint, New York Medi

The severe cases, with scanty urine, fever, and marked dropsy, require more active treatment. Free diaphoresis should be maintained by the hot pack or vapour bath (page 54), and in bad cases even pilocarpine may be used hypodermically, a dose of gr. $\frac{1}{60}$ being given to a child of three or four years. To counteract the depressing effects of this drug, stimulants should be given at the same time. Active counter-irritation should be maintained over the kidneys by dry cups followed by poultices, or the mustard paste. Two or three loose movements from the bowels should be secured by the administration of calomel, or, better, by Rochelle, or Epsom salts. Harm is sometimes done by carrying this depletion too far, and its effect upon the patient's general condition must be closely watched. If suppression of urine occurs with the development of uræmic symptoms—delirium, high temperature, flushed face, vomiting, and a pulse of high tension—nitroglycerin may be given; a child of five years may take gr. $\frac{1}{125}$ every hour for three or four doses, or until an effect is produced. Uræmic convulsions may often be averted by the use of morphine hypodermically; but if the symptoms are very urgent, nothing is so rapid or so certain to give relief as venesection. This has lately been revived in the practice of New York physicians, and has now the endorsement of the best practitioners in the city. From a child of five years from two to six ounces of blood may be taken, according to the general condition and the urgency of the symptoms. Even though the improvement which follows bleeding under the conditions mentioned is very certain, it is often only temporary; but it gives time for the use of other measures, such as catharsis and diaphoresis. The depressing effects may be largely overcome by following the venesection by an intravenous injection of a saline solution (gr. iv to water ℥ j). The amount introduced should be nearly twice that of the blood taken.

One should always be on the lookout for complications, especially dropsy of the serous cavities, pericarditis or endocarditis, and œdema of the lungs. Convalescence is nearly always slow, and a patient who has suffered from nephritis needs careful attention for a long time. Anæmia is always present, and iron is required. The diet must consist largely of fluids for several months. If the disease tends to pass into a subacute form, the child should, if possible, be sent to a warm climate, and kept there during the succeeding winter, and every means taken to build up the general nutrition. Flannels should be worn next to the skin, and every precaution taken against any exposure which might cause an exacerbation of the disease.

CHRONIC NEPHRITIS.

Chronic inflammation of the kidney is an infrequent condition in childhood. In infancy it is almost unknown, except in connection with congenital hydronephrosis or other malformations of the kidney. Two

pathological varieties are met
exudation, known also as the
tous nephritis, and waxy kidne
exudation, known also as inters
tracted kidney.

Etiology.—Chronic nephriti
acute nephritis of scarlet fev
suppuration of chronic bone o
from the beginning. The onl
hereditary syphilis, alcoholism,
of the heart. Nearly all the
of age.

Lesions.—The lesions of chr
essentially from those seen in
with exudation, the kidneys ar
or slightly nodular, and yellov
shows that the renal epitheliu
erated. The tubes contain cast
epithelial cells. In some places
the glomeruli there is a growth
of the tufts, with the formation
waxy degeneration, the kidneys
a glistening gray colour. Amylo
small arteries of the kidney and
iodine the mahogany-brown rea
the kidney are nearly always ass
and spleen, and sometimes also in

In the *chronic diffuse nephr*
the organs are smaller than norm
capsule. The cortex is thinned,
tion to the lesions found in the
production of new connective t
throughout the kidneys. The tu
cysts of considerable size, while
peared. The glomeruli may be
chronic congestion has preceded t
the capillaries dilated.

Symptoms.—1. *Chronic nephri*
ease is not usually chronic from
from which the patient is often
The symptoms sometimes immedi
there is an interval of apparent re
even years. Very rarely no such hi
be obtained, and the symptoms co

cases occur chiefly in older children, and their clinical features do not differ essentially from those of adult life.

As a rule dropsy is present, although it is variable in amount, and fluctuates considerably from time to time. There may be not only œdema of the cellular tissue, but effusion into the pleura, peritonæum, and even the pericardium. As the case progresses, anæmia is always a marked symptom. There are various disturbances of digestion—loss of appetite, occasional vomiting, and attacks of diarrhœa. From time to time nervous symptoms may be quite prominent, such as headaches, sleeplessness, neuralgia, fatigue upon slight exertion, and dyspnœa. Attacks of epistaxis are not infrequent.

The urine contains albumin and casts nearly all the time. They vary much in amount at different periods in the disease, according to the rapidity of its progress. During periods of exacerbation, both albumin and casts are very abundant, while in the intervals the amount of albumin is small and the casts few. The casts are hyaline, granular, epithelial, and fatty. The daily quantity of urine is much reduced during the periods of exacerbation, while at other times it may be nearly normal. The specific gravity is usually low.

If waxy degeneration is present, there are generally associated with the renal symptoms, others dependent upon waxy changes in other organs. The spleen and liver are enlarged; there may be ascites and diarrhœa, and there is usually present the peculiar "alabaster cachexia."

The duration of this form of chronic nephritis depends much upon the surroundings of the patient and the treatment. It is rarely shorter than two years, and it may last for many years. The progress is always irregular, and marked by periods of exacerbation and remission. The patients die from acute uræmia, or from complicating pneumonia, pleurisy, pericarditis, endocarditis, or from pulmonary œdema.

2. *Chronic nephritis without exudation.*—This is a very rare disease in early life, being much less frequent even than the preceding variety of nephritis. In some cases there is a history of hereditary syphilis; in others, of chronic alcoholism. The early symptoms are few, and the disease usually develops insidiously. The urine is pale, excessive in amount, and of low specific gravity—1·001 to 1·008. Albumin is more often absent than present, and, when found, the quantity is small. Dropsy likewise is rare, and never marked. Nervous symptoms are often prominent, such as headaches, attacks of spasmodic dyspnœa resembling asthma, neuralgias, and disturbances of vision. High arterial tension and hypertrophy of the left ventricle are regular symptoms; and even atheromatous degeneration of the arteries may be present. Dickinson reports an instance of this in a patient only six years of age. Late in the disease, hæmorrhages may occur, and these may be the cause of death. Filatoff has reported a cerebral hæmorrhage in a child of eleven.

Acute uræmia is, however, the
The course is slow, and the
uræmic symptoms occur.

Prognosis.—The prognosis
is always unfavourable; and a
are absent for several years, t
been reported of recovery fro
removal of the bone disease
though symptoms may be abse
doubtful. An extended perioc
tient can be pronounced cured.
prognosis can be given because,
possible to determine exactly th
the rapidity of its progress. A
sage of a large amount of uri
be interpreted as evidence of
and is a bad symptom. A la
valvular disease of the heart, a
by a quantitative examination
symptoms.

Diagnosis.—Chronic nephrit
looked because of the failure to
and frequent examinations shou
persistent or frequent headaches
high arterial tension and of ge
more obvious symptoms of rena
are present. Nor should one be
tional albuminuria because he
small quantity. All such cases
closest attention for a long perio

Treatment.—Children with
same general plan as adults. T
much as possible the progress of
as they arise. It is of the greate
conditions in which exacerbatio
he should be sent to a warm,
to cold avoided; an out-door li
general tonic treatment with ve
carried to the point of fatigue, a
position, a fluid diet, consisting
borne, and the administration o
chloride. Excessive dropsy calls
stimulants. If uræmia develops,
headache, and convulsions, vene

glycerin used. Morphine may be given hypodermically if the pupils are dilated and nervous symptoms are very marked.

TUBERCULOSIS OF THE KIDNEY.

In general tuberculosis, miliary tubercles are frequently seen both upon the surface of the kidney and in its substance. These give rise to no symptoms and are of no clinical importance. Larger tuberculous deposits are extremely rare in early life. They usually occur in patients who are the subjects of general tuberculosis, and are associated with tuberculosis of other parts of the genito-urinary tract; or they may exist as the primary, and even the only, tuberculous lesion in the body. At least two such cases are on record in children, one reported by West and the other by Rilliet and Barthez. Infection of the kidney generally takes place through the circulation, and not from the bladder. Aldibert's figures show that in children the bladder usually escapes even when the kidneys are tuberculous, for of thirteen cases of renal tuberculosis the bladder was involved in but two. The ages of twelve of these patients were as follows: from two to four years, four cases; from seven to eleven, five cases; from eleven to fourteen, three cases. The disease probably begins in the mucous membrane of the pelvis and the calices of the kidney, and extends to the pyramids, finally involving the cortex. As a rule, but one kidney is affected. The process may be confined to the pyramids, where are found cheesy nodules which may be single or multiple. These ultimately break down and form abscesses. The process may result in almost complete destruction of the pyramids, and even of portions of the cortex, so that the kidney may consist of a mere shell of renal tissue. Suppuration in the neighbourhood of the kidney (perinephritic abscess) often coexists.

The symptoms are quite indefinite. There may be localized pain and tenderness in the region of the kidney, and a tumour if there is perinephritis. The symptoms of irritability of the bladder may be almost as severe as in cases of calculus. Pus appears in the urine usually as a constant symptom; but the only thing that is diagnostic is the discovery of tubercle bacilli in the urine.

The treatment of renal tuberculosis is purely surgical. Of the thirteen cases collected by Aldibert in which nephrectomy was done for this condition, there were nine recoveries and four deaths; two of the deaths, however, not being traceable to the operation or to the original disease. No recurrence had taken place in one case at the end of eight years, and none in another after three years.

MALIGNANT TUMOURS OF THE KIDNEY.

In the great majority of cases tumours of the kidney are malignant. Of fifty-one cases collected by Aldibert which were operated upon, forty-eight were malignant and three benign.

Malignant growths are almo
five years, although not commo
variety of malignant tumour of
were classed as carcinoma. It
very infrequent, and that nea
Fischer reports nineteen of s
thirty-eight of sarcoma and fi
round- or spindle-celled, or my
both sarcomatous and carcino
classed as sarcomatous carcino
of the kidney, or from the pelv
infiltrate the whole kidney, so t
maining, or it may form an imm
which is only partially invade
but they are quite soft, and h
stance. Secondary growths ma
peritoneal glands, in the oppo
pancreas. Pressure of the tumo
phrosis; and upon the inferior
As it grows, the tumour somet
abdominal organs by localized
it very rarely causes general per
size, usually from five to fifte
Jacobi it weighed thirty-six pou
the right kidney was involved
2 cases.

Etiology.—These tumours o
was true of 5 cases in a series
ity occur in early childhood. I
street Taylor in which the ag
years, and 57 of these in the
about equally affected. In a sm
was given.

Symptoms.—The principal s
cachexia. The tumour is usuall
covered in the loin, but grows
surface may be lobulated and i
solid, it is sometimes so soft as
tion. It may grow to an enor
liver, spleen, intestines, and lung
ally rapid, so that from the size
course of three or four months
palpation it will be found—cert
although it may be quite freely r

bar spine. Aspiration may show blood, but more frequently the result is negative.

Hæmaturia was observed before the tumour in 19 of 50 cases (Seibert), it being then the first symptom noticed. The amount of blood passed is sometimes quite large, but is usually small, and may be discovered only by the microscope. Pain is rare, and is due to localized peritonitis. Constitutional symptoms are absent until the tumour has attained a large size, when a cachexia develops and the patient wastes steadily while the tumour continues to grow. The pressure effects are dyspnœa, from compression of the lungs; œdema of the lower extremities, from pressure upon or thrombosis of the vena cava; vomiting and indigestion, from pressure upon the stomach and intestines. Secondary deposits very rarely cause any symptoms except in the lungs, where they may give rise to cough, and even to hæmoptysis.

The course of the disease is steadily from bad to worse. The usual duration of life in patients not operated upon, is from three to ten months after the tumour is discovered; very rarely do they live a year, death usually occurring from exhaustion.

Diagnosis.—The diagnosis of sarcoma of the kidney is usually quite easily made from the position and attachment of the tumour, its rapid growth and solid character, the existence of hæmaturia, and the age of the patient (under five years). It may be confounded with hydronephrosis, dermoid cyst of the ovary, enlargement of the spleen, retro-peritoneal sarcoma, tumours of the liver, or even of the abdominal wall.

Treatment.—Nothing is to be said regarding the medical treatment of these cases. Unless operated upon, I believe they invariably terminate fatally. The results of operation during recent years have been so encouraging that no case should be abandoned, no matter how young the patient. Aldibert has collected the results of forty-five cases operated upon: twenty deaths occurred soon after the operation, two thirds of them from shock; in eleven cases recurrence of the growth occurred within nine months, and caused death. This raises the total mortality to 78 per cent. Recently, in the Babies' Hospital, two cases have been successfully operated upon by my colleague, Dr. Robert Abbe; one, a nursing child, thirteen months old, where the tumour weighed seven pounds, and the child after the operation only fifteen pounds. This case made an uninterrupted recovery, and three years after the operation was in perfect health. The accompanying illustrations (Figs. 106 and 107) are from photographs of this patient. The second case was in a child two years old, and the tumour weighed two and a quarter pounds. The child made an excellent recovery, and was in perfect health three years and nine months after the operation. These results certainly are encouraging, and show conclusively that infancy is no contraindication to the operation.

For a discussion of the surgical aspects of this question, and details of the operation, see the papers of Abbe * and Aldibert.†

Benign Tumours.—These are distinguished by their slow growth, and by the fact that the constitutional symptoms are mild or wanting. Of the three cases collected by Aldibert, one was adenoma, one fibroma, and one was fibro-cystic. Two cases recovered, and one died of septic peritonitis. The duration of the disease was from twenty months to six years.

PYELITIS.

Pyelitis is an inflammation of the mucous membrane lining the pelvis of the kidney. It may exist alone, or with an inflammation of a portion of the ureter, or of the kidney itself (pyelo-nephritis); and it may be acute or chronic. It may result in an accumulation of pus in considerable quantity in the pelvis of the kidney (pyonephrosis).

Etiology.—Of local causes, the most frequent is irritation from renal calculi. It is also associated with congenital malformations of the kidneys or ureters, with renal tuberculosis and renal tumours. It may result from an extension of inflammation from the tissues surrounding the kidney (perinephritis), or from an abscess opening into the pelvis of the kidney. The secondary pyelitis, which so often follows cystitis in adults, is an extremely rare occurrence in childhood. In addition to the forms mentioned, there is seen an infectious form of acute pyelitis, which usually occurs as a complication of scarlet or typhoid fever, diphtheria, malaria, or pyæmia; but it is also seen apart from these diseases, when it occurs apparently as a primary affection. I have seen in infants three cases of this description. In this group of cases the infection is probably through the circulation, but in the cases which occur independently of the acute infectious diseases it may be impossible to determine the point of entrance of the infection. In most, if not all these cases there is also present a certain amount of nephritis.

Lesions.—When pyelitis develops from a local cause it is usually unilateral. In the infectious form both kidneys are involved. In the acute cases there are the usual appearances of an acute catarrhal inflammation of the mucous membrane, with congestion, swelling, and sometimes minute hæmorrhages. In chronic cases there is thickening and sometimes a granular condition of the lining membrane. There may be an accumulation of pus of considerable size, distending the pelvis and calices (pyonephrosis). If the condition is one depending upon a calculus or congenital deformity, and in all protracted and severe cases, the kidney itself is involved to a greater or less degree; the extent of the nephritis will depend upon the nature of the exciting cause and the duration of the process.

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* Annals of Surgery, January, 1894.

† Revue Mensuelle des Maladies de l'Enfance, November, 1893.

Symptoms.—The history c
clinical features of acute inf
apparently as a primary diseas

A previously healthy fema
denly with a chill, followed b
ten days before the nature of
time the temperature ranged
nearly every day; but the ch
tional symptoms were not seve
there was found a large amou
one twelfth of the volume of t
acid. There were no signs of
evidence of local pain either i
quency of micturition, no loc
later examinations there were
from the bladder, and the tub
hyaline casts, but not more a
amount of pus. Under no trea
perature gradually fell to nor
quantity, and at the end of fiv
the urine. A report sixteen m
mained well and entirely free fr

In some cases there are re
temperature; in others there
and few other constitutional sym
the acute infectious diseases,
urine in acute pyelitis is turbi
of which may be from one to
The quantity of urine is gener
quite scanty. The reaction is
pus is large. Albumin is presen
the degree of nephritis. Red b
in most of the very acute case
colour the urine. The pus cells
but in old cases they may be
cells—conical, fusiform, and irr
be renal epithelium and hyalin
number with the severity of th
great numbers.

In chronic pyelitis only pyu
tumour owing to the pyonephro
form there may be intermittent
above described. In pyelitis de
pyuria is usually the only sympto

calculi we may have acute or chronic pyelitis; there may be localized pain, tenderness, sometimes a tumour, occasionally hæmaturia, and perhaps a history of renal colic or the passage of gravel. With tuberculosis we have chronic pyuria and the presence of tubercle bacilli in the urine. There are commonly associated the symptoms of general tuberculosis. If associated with perinephritis, the inflammation is usually acute, and there are present the local symptoms of the original disease. If an abscess opens into the pelvis of the kidney we may have a sudden discharge of pus in large quantity with a subsidence of previous local symptoms, including the tumour. With neoplasms we have congestion and hæmorrhage more frequently than pus, but both may be present.

Diagnosis.—The characteristic symptoms of acute pyelitis are a chill, which may be repeated, high and fluctuating temperature, scanty urine, frequently pain and tenderness over the kidneys, and pyuria. The diagnosis of pyelitis is made only by an examination of the urine, which should never be omitted in cases of obscure high temperature, even in infancy, particularly if chills are associated. Given the existence of a large amount of pus in the urine, it may be difficult to decide whether this comes from the bladder or the kidney. Pus from the bladder is exceedingly rare in children even when a vesical calculus is present. If the pus comes from the opening of an abscess into the bladder, ureter, or pelvis of the kidney, the local signs of such abscess will usually be present. The existence in an acid urine of a large amount of pus, many epithelial cells like those described, with high fever and chills, are generally sufficient to establish the diagnosis of pyelitis.

Prognosis.—In cases apparently primary, and in those complicating infectious diseases, the prognosis is good. The danger is chiefly from the nephritis which follows or complicates the process. In cases depending upon local conditions, the prognosis will depend upon the nature of the exciting cause. Here, also, the principal danger is from nephritis. If calculi are present and if pyonephrosis develops, the patient may die from exhaustion before a serious degree of nephritis has developed.

Treatment.—In all cases the diet should be fluid. Water should be given freely, and alkalies up to the point of neutralizing the excessive acidity of the urine. In infants, from twelve to twenty-four grains of the citrate of potash are required daily for this purpose. If the urine is alkaline, benzoic acid may be used in the same doses. In acute cases, counter-irritation over the kidney by means of poultices or dry cups may be employed. If calculi are present the same treatment is indicated. Surgical interference is called for if pyonephrosis develops, or if the disease is evidently unilateral and the kidney is becoming disabled. The advisability of surgical interference will depend upon the clearness and severity of the symptoms.

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Small renal calculi are ve
room of the Babies' Hospital
of young infants, fine brown
casionally a calculus as large
composed of uric acid. Only
which I have records, was a sto
fant. In this case it was an in
surprising that these are so ra
the minute calculi are met wit
majority of them have been di
and passed *per urethram* beca
The granular deposits are usua
are generally seen upon both s
often a slight catarrhal pyelitis.

Symptoms.—The small dep
large calculi may be found at
ence had existed during life, as
times symptoms are produced
the adult.

There may be tenderness wit
kidney, or radiating to the bla
kidney, and there may be irrit
urine may show, especially after
the added symptoms of pyeliti
and the appearance in the urine
of the kidney.

Renal colic is produced whe
from the kidney to the bladder.
to those seen in the adult. The
pain in the loins, shooting down
be vomiting and even collapse.
quantities, and contains blood.
stone reaches the bladder. The
in the ureter and give rise to hy
becomes pyelo-nephritis.

Treatment.—The treatment
ducted upon the same general pr
be suspected, but a positive diag
of gravel in the urine. When
largely fluid, and alkaline waters
enough to give positive symptom
a surgical operation should be con

tion to the severity of the symptoms and the clearness of the diagnosis. If calculous pyelitis exists, it is certain sooner or later to lead to serious nephritis, and it is only a question of time when the kidney will be disabled. The same is true of hydronephrosis from the impaction of a calculus in the ureter. Aldibert has collected four cases of nephrectomy in children for renal calculi in which the kidney was healthy, with three recoveries and one death from shock. In nine cases of operation for calculous pyonephrosis, there were six recoveries and three deaths. This is certainly an encouraging showing, and should lead one to consider operation seriously in many cases for which formerly nothing was done. The earlier the operation the greater the chances of success, because of the better condition of the other kidney. Although the continued use of water and the so-called solvents may relieve some of the symptoms, it is very questionable whether they do more.

TRAUMATIC HYDRONEPHROSIS.

In addition to the hydronephrosis which results from congenital malformations and from the impaction of calculi, a form is occasionally seen following severe injury to the kidney. The pathology of hydronephrosis in these cases is not well understood. After the early symptoms of traumatism have subsided, there develops in from two weeks to two months a tumour in the region of the kidney, which may reach a considerable size and present all the ordinary characteristics of hydronephrosis arising from other causes. This tumour may disappear spontaneously, or it may increase in size and demand surgical intervention for its cure. In seventeen cases which Aldibert has collected there was only one of spontaneous recovery; aspiration was done in seven cases, with six cures and one death; incision with or without nephrectomy was practised in nine cases, with seven recoveries and two deaths.

PERINEPHRITIS.

This consists in an inflammation in the cellular tissue surrounding the kidney, which may terminate in resolution or in suppuration. It is not of very uncommon occurrence, and is of importance chiefly from the frequency with which it is confounded with disease of the hip or spine. Perinephritis may be secondary to suppurative processes in the kidney itself, whether from calculi or tuberculous deposits, or it may be primary. In children the latter is the common form. Primary perinephritis is attributed to traumatism, cold, or exposure, or it may develop without assignable cause. It usually runs an acute or subacute course; very rarely it may be chronic.

For the clinical picture of this disease I am chiefly indebted to a paper by Gibney, who published in 1880 a report of twenty-eight cases of

primary perinephritis in child
Hospital for the Ruptured a
were under observation, and
reported in Dr. Gibney's pape

The ages of these patient
years, the majority being bet
and the two sexes were about
cases were clearly traceable t
exciting cause could be disco
ferred to the hospital with th
the spine. Resolution followe
minated in suppuration.

When abscess forms, it us
and comes to the surface pos
space; it may burrow forward
just above Poupart's ligament;
and appear at the upper and i
psoas abscess; or it may open i

Symptoms.—The onset of
with chill, fever, and localized p
the spine, lameness referred to
of the flexors of the thigh. Th
be referred to the groin, to th
It is often severe, and increase
accompanied by localized tende
There is lameness upon the af
being sometimes referred to the
symptoms often develop slowly i
are usually accompanied by a
most acute cases the temperatur
severe.

As the disease progresses fev
usually varying between 101° an
ing deformity, and finally the p
examination at the height of th
a deviation of the spine with the
thigh may be held flexed to a r
and causes pain, although all th
normal. In the lumbar region
area of infiltration filling the ili
preciable by percussion, but la

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* Chicago Medical Journal and E
bibliography.

addition to the tumour in the usual region, there is sometimes one at the upper and inner aspect of the thigh, owing to a burrowing of pus, and the sacs may communicate.

Lameness, pain, deformity, and fever sometimes exist for two or three weeks before any tumour can be made out. The constitutional symptoms are often severe, and symptoms of the typhoid condition may even be present. The bowels are usually constipated. The size of the abscess is sometimes very great. In one case I have seen it extend from the spine to the median line in front, and from the crest of the ilium nearly to the free border of the ribs. The amount of pus varies from a few ounces to two or three pints. Urinary symptoms are sometimes wanting; at other times there is increased frequency of micturition, accompanied by pain from an irritation referred to the bladder. The urine may contain pus from a complicating pyelitis. In only one of Gibney's cases was this present. It developed in the fourth week, and the case recovered.

The duration of the disease in the acute cases varies from three to eight weeks; in the subacute it may be five or six months. When suppuration occurs the symptoms subside quite rapidly after the pus has been evacuated, and recovery is complete. Where resolution takes place, there is a gradual subsidence of the symptoms, and often some stiffness of the thigh, with slight lameness for several months. In the series of cases above referred to, 65 per cent recovered completely in three months.

Diagnosis.—In many cases a diagnosis of hip-joint disease is made, and they are reported as "hip-joint disease cured without deformity," etc. The points of differential diagnosis are quite distinct, and if a careful examination is made there is no excuse for confounding the two conditions. Hip-joint disease develops more insidiously, is very much more chronic, and rarely produces so great deformity in a year as is often seen in perinephritis in two or three weeks; abscess is infrequent during the first year of the disease; on examination, there is found limitation of all the movements of the joint, and not of extension alone; atrophy of the thigh and joint tenderness are present. In perinephritis, on the other hand, we have a tolerably acute onset, sometimes with chill, fever, marked lameness, and deformity, developing in two or three weeks; abscess often forms in a month, and complete and permanent recovery usually follows after a few months at most; the deformity is due solely to flexion of the thigh; all other movements at the hip may be free, and joint tenderness is absent. Psoas abscess from Pott's disease may cause deformity, tumour, and lameness similar to that seen in perinephritis, but on examination there is found the angular prominence and other signs of disease of the lumbar vertebræ.

Prognosis.—Primary perinephritis in children almost invariably terminates in complete recovery. Of the twenty-eight cases referred to, and eight subsequently observed by Gibney, all recovered perfectly. The only

condition liable to prove fatal
cavity.

Treatment.—The patient
possible throughout the attac
tations, or an icebag, should
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a poultice may be used. Ab
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GENERAL ŒDEMA NOT

This is of not very infreq
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œdema of the feet, ankles, th
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may be almost impossible to o
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The cause of this œdema wa
it in connection with prematur
too much fluid food. He states
food was reduced. This has n
who were fed by gavage showed
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nation seems to me to be that it
associated with feeble resistance
through which a transudation of
of anæmia noted in these patient

The prognosis in this condi
except in hopeless cases of mar
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permanently and the case go on t

If the urine is scanty, such
sweet spirits of nitre often cau
disappearance of the dropsy in a

however, is digitalis. To an infant of two months, ♏ $\frac{1}{10}$ of the fluid extract may be given every two hours for two or three days; and for a short period somewhat larger doses may be employed.

CHAPTER III.

DISEASES OF THE GENITAL ORGANS.

MALFORMATIONS.

Adherent Prepuce.—This condition is sometimes called false phimosis. It is so constantly present that it can hardly be regarded as a malformation. It is, however, a condition needing attention in every male infant. The prepuce should be forcibly retracted so as to expose the glans completely. The smegma should then be washed away, the glans covered with a drop of oil, and the skin drawn forward. This should be repeated daily until there is no disposition to a recurrence of the adhesions.

Phimosis.—This is such a narrowing of the prepuce that it can not be retracted over the glans. The degree of phimosis varies greatly. In very rare cases there is no preputial opening. In other cases the orifice is so small that no part of the glans can be exposed, and there is obstruction to the outflow of urine; but usually a small part of the glans can be seen. Phimosis may be complicated by an elongated prepuce (hypertrophic phimosis), and the elongation may exist without any narrowing of the orifice, although this is usually present to some degree.

The presence of phimosis makes cleanliness impossible in many cases, and want of cleanliness leads to infection and to balanitis. This is quite frequent even in infants. It may be complicated by urethritis, and even by cystitis. Another consequence of the straining induced by phimosis is hernia, which may be either inguinal or umbilical. To cure the hernia is often impossible, unless the phimosis is relieved. Straining also leads to prolapsus ani, and, from pressure on the spermatic vessels, to hydrocele. More important even than these mechanical results of phimosis are the reflex conditions resulting from the irritation. Such symptoms may come from preputial adhesions as well as from phimosis. The hyperæsthetic condition and the resulting pruritus cause frequent priapism, and are among the most common causes of masturbation. It may produce other nervous symptoms, such as insomnia, night terrors, etc. Phimosis often causes frequent micturition, dysuria, and, in fact, most of the symptoms of stone in the bladder. It sometimes leads to vesical spasm and retention of urine, but more frequently to nocturnal incontinence.

The list of reflex phenomen
is a long one, and includes n
childhood. There is abundan
although a rare one, of chor
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symptoms resembling the ear
amaurosis, diarrhœa, and many
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Treatment.—Every case of
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of the glans can be exposed, th
of the prepuce with a pair of scis
The corners of the flaps thus ma
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treatment applied. In all cases
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treatment.

Hypospadias.—In this conditi
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severe cases there is a deep fissur
times even the perinæum. Into
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the testicles are frequently in the
to decide the sex of the child unti
relief of these deformities are not

Epispadias.—This is a conditi
dorsal surface of the penis. It i

There may be simply a division of the glans, or the fissure may extend the whole length of the organ and be complicated by—

Exstrophy of the Bladder.—This deformity is met with in all degrees of severity. In the complete form there is a median fissure from the umbilicus to the tip of the penis. It includes the anterior abdominal wall, the pelvic bones, and the urethra. The bones are entirely separated at the symphysis, or connected behind the bladder by a fibrous band. The hypogastric region is occupied by a red, mucous surface, slightly corrugated, which is all there is of the bladder. This is generally surrounded by a narrow rim of integument. In the lower lateral portions of the red mucous membrane two slightly rounded elevations are seen, from which urine oozes. These are the openings of the ureters. The penis is short, and presents a shallow furrow on its dorsal surface. With this deformity, also, the testes are often in the abdominal cavity.

An analogous deformity is sometimes seen in girls. There is a division of the clitoris and the labia minora and majora. The fissure may be so deep as to reach nearly to the anus. The vagina is usually absent. The rectum may open into the prolapsed bladder.

All these deformities are compatible with long life. In most of them the individual is incapable of procreation. In exstrophy of the bladder, whether complete or partial, patients are a nuisance to themselves and to all about them. It is almost impossible to prevent the clothing from being soaked with urine, which gives everything connected with the patient a strong ammoniacal odour. The skin is often excoriated. Operation for the relief of these cases should, I think, always be undertaken. Brilliant results have been obtained even in some of the most severe cases.

Undescended Testicle—Cryptorchidism.—In fœtal life the testes are situated in the abdominal cavity below the kidneys. They usually descend into the scrotum during the ninth month, but in children born at full term the testicle may be in the inguinal canal, or even in the abdomen. The former condition is quite a frequent one, being present, according to good authorities, in fully ten per cent of all children. In the great majority of these the descent takes place without difficulty during the first weeks of life, and causes no symptoms. In others the condition persists. The testicle may be found in the abdominal cavity or at any point in the canal. If the latter, it may be felt as a small, hard tumour, slightly painful upon pressure. Even in some of these cases a natural descent takes place about puberty, usually without symptoms. The testicle occasionally makes for itself a false passage, and is found in the perinæum. When in the inguinal canal, descent of the testicle into the scrotum may sometimes be facilitated by manipulation. In other situations it had best be left alone, unless it gives rise to much pain or tenderness, as may happen when a false passage has been made. It should then be removed.

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of the internal organs, and do

DISEASES OI

Balanitis.—Balanitis, or in
results of phimosis. It may f
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tion usually subsides in two o
charge for a considerable time.
of the prepuce. The most sev
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The object of treatment is
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This should be repeated severa
contact with the syringe, so tha
it is impossible to do this, an an
until the œdema has subsided.
prepuce before the parts can be
this is often the quickest meth
done during an attack.

Urethritis.—This, like the sa
specific. Both forms are less fre
In simple urethritis the inflamm
of the canal, the fossa navicularis
sometimes pain on micturition.
cleanliness.

Gonorrhœal inflammation is
as young as eighteen months, b
seven years old. The usual cause
more severe than in the simple
the adult, with the exception that
sent. A microscopical examinati
positive means of diagnosis betwe
reveals the gonococcus in great
are seen as complications, just
but balanitis and bubo are not in
in a boy of three years, who, whe
urethral stricture. He was infect

The first thing in the treatm
otherwise the infection is almos

other mucous membranes, usually the conjunctiva. In other respects the treatment is the same as in the adult.

Hydrocele.—Hydrocele consists in an accumulation of serum in some part of the serous pouch brought down by the testicle in its descent. In infants it is usually due to the imperfect closure of this pouch at some point, where a fluid accumulation occurs. Four varieties of hydrocele are met with in young children:

1. *Congenital hydrocele.*—In this the condition is a congenital one, although the tumour is not necessarily present at birth. The tunica vaginalis communicates with the general peritoneal cavity. There is present an elongated tumour, extending from the bottom of the scrotum throughout the whole length of the cord. The tumour is reducible, sometimes spontaneously by position, sometimes, when the opening is smaller, only by pressure. It reduces slowly, without gurgling, never going back *en masse* like a hernia. The tumour is translucent, and is flat on percussion. The testicle is above and posterior, and usually indistinctly felt. Congenital hydrocele may be complicated by hernia.

2. *Hydrocele of the tunica vaginalis with the canal closed.*—In this form the accumulation of fluid is in the scrotum, communication with the peritoneal cavity having been entirely cut off by the complete obliteration of this pouch in the canal in the normal way. This is one of the most frequent forms. It gives rise to an oval or pear-shaped tumour, quite tense and firm, usually about two inches in length. The cord is distinctly felt above it, the testicle is behind and somewhat above it, and not always felt very distinctly. This variety gives translucency and the usual elastic feeling of a hydrocele.

3. *Hydrocele of the cord.*—This is one of the rare forms. The serous pouch which accompanies the spermatic cord is open above, and communicates with the peritoneal cavity; but below it is closed. The scrotum is normal, and the testicle is in its usual position. The tumour is small, elongated, and reducible, and entirely above the scrotum. Usually it stops at some point in the inguinal canal. This hydrocele also may be complicated by hernia. The diagnostic points are the same as in the form first mentioned.

4. *Encysted hydrocele of the cord.*—The peritoneal pouch of the cord in this variety is closed for some distance above, and again below, but somewhere in its course it is open, and here the fluid accumulates in the form of a cyst. When small it resembles an undescended testicle; but on examination this organ is found below and in its normal position. When in the canal, it is often mistaken for a lymph gland, sometimes for a small hernia. The tumour is usually about the size of an almond. It is elastic and irreducible, and gives translucency like the other varieties. In cases of doubt it may be punctured by a hypodermic needle.

Treatment of Hydrocele.—I
cause obliteration of the canal,
general peritoneal cavity. This
if applied early, it may be acc
It is subsequently managed li
vaginalis. In infants and youn
measures are called for in any
great majority of cases at least
of a few months. Absorption
collodion. In many cases the
tassium, twelve grains a day, ca
Iodine may be applied locally
not be applied to the scrotum.
promptly, simple puncture with
into the cellular tissue of the s
excellent means of treatment.
with hypodermic syringe. I ha
hundred of these hydroceles in
never yet seen one in which it wa
irritants like iodine or carbolic a

DISEASES OF T

VULV

This is a catarrhal inflamma
brane of the vulva, vagina, ureth
It may be simple or specific (gono

Simple Vulvo-vaginal Catarrh.
infancy. It is, however, most fre
often occurs in girls who are a
than in those whose general heal
those who live in unhygienic surr
is neglected. It may follow any
measles. There seems to be litt
spread by contagion. It is comn
small epidemics are sometimes se
contact, or by handling the parts,
towels, etc. The disease may be
the introduction of foreign bodie

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* See "Twenty-one Cases of Rape in
trics, vol. iii, 1886, where the medico-leg
fully discussed.

of pinworms, or to scabies, and it is sometimes the cause, sometimes the result, of masturbation.

Symptoms.—The disease generally begins as a subacute catarrhal inflammation, the discharge being the first thing noticed. In the milder cases this is thin and yellowish-white, with some pain on locomotion, itching, and burning on micturition. In the more severe form it is abundant and of a yellowish-green colour, causing the labia to adhere, and the secretion, drying, forms crusts. The odour is sometimes extremely fetid, and the skin of the thighs may be excoriated. The local examination shows the mucous membrane to be red, swollen, œdematous, and bathed in pus. All the visible parts—urethra, hymen, vagina, etc.—are involved. By using an ordinary urethral speculum in the vagina, pus may be seen in most of the severe cases to come from the cervix uteri (Koplik). There are no constitutional symptoms. There may be swelling, and even suppuration, of the inguinal glands. The disease has no definite course, but usually with proper treatment lasts from one to three weeks, when there may be complete recovery, or there may persist for a long time a leucorrhœal discharge. In children who are in poor general condition, and where proper means of treatment are neglected, vulvo-vaginitis may last for months.

Gonorrhœal Vulvo-vaginitis (Uro-genital Blennorrhœa).—Recent studies of the micro-organisms in the discharge have shown cases of true gonorrhœa in young girls to be very much more numerous than was formerly suspected.* While indirect infection is no doubt possible, and in certain cases proved, nearly all writers agree that this is very exceptional, and that the most common origin of the disease is direct contact, either intentional or accidental, with another case of gonorrhœa, sometimes sexual and sometimes by the hands. In this way the disease may be conveyed from one child to another, or from adults to children, very often from parents who occupy the same bed with the child. Pott states that, in 90 per cent of his forty-four cases, the mothers were found to be suffering from leucorrhœa. The mode of contagion may be difficult to trace, but this fact should cast no doubt upon the diagnosis in the case. The disease occurs in girls of all ages, but chiefly between three and eight years. Epstein has reported cases in the newly-born. The incubation in three cases in which it could be definitely traced, was exactly three days (Cahen-Brach).

Symptoms.—The disease is believed to begin usually in the urethra, although this is in most cases difficult to establish, as there are generally found on the first examination evidences of inflammation of all the mucous membranes of this region. There is a copious secretion of thick, yellow pus. There may be erosions of the vaginal mucous membrane, so that the parts bleed readily. Crusts form on the labia. When a view of the cervix can be obtained by means of a small speculum, this is almost invariably seen to be involved. For the first day or two, in the most severe cases, there may be slight fever and general indisposition, but more frequently—and this is one of the most striking points of difference from the disease as seen in adults—constitutional symptoms are wanting altogether. Micturition is painful, and sometimes frequent, there are also excoriations of the skin, and difficulty in walking, all these symptoms being usually more severe than in simple catarrh. The duration of these cases is indefinite, being from one to six months. Under the most favourable conditions it is several weeks, largely owing to the great difficulties in the way of a thorough application of local treatment. It is always more obstinate than is a simple catarrh.

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* For an excellent *résumé* of this subject, with references to recent literature, see Koplik, Journal of Cutaneous and Genito-Urinary Diseases, June, 1893; also Heiman, New York Medical Record, June 22, 1895.

A positive diagnosis between the simple and gonorrhœal catarrh can be made with certainty only by a microscopical examination of the discharge. The pus for examination should be taken from as high a point in the tract as possible, preferably the orifice of the urethra, in order to avoid contamination. In a simple catarrh the discharge is made up of epithelial and pus cells, with quite a variety of bacterial forms—bacilli, cocci, and diplococci. These bacteria are found in the epithelial cells and in the pus cells, but they are generally associated, and the diplococci are few in number. In cases of gonorrhœal inflammation there are found in the pus cells large masses of diplococci, these being usually the only bacteria present. It should then be emphasized that the mere presence of a few diplococci, even though found in the pus cells, is not enough to establish the diagnosis of gonorrhœa, since there are varieties of diplococci found in the simple catarrh, and even in the normal vaginal secretion, which morphologically closely resemble the gonococcus of Neisser. It is the presence of these in large masses in the pus cells which is the characteristic feature (Koplik). According to the very careful observations of Heiman, the two varieties of diplococci may be positively differentiated by staining by Gram's method. The gonococcus is decolourized, while the other form is not.

Nearly all the complications of gonorrhœa which are seen in the adult have been observed in young children, but the majority of them are rare. The most frequent one is conjunctivitis, infection being carried by the hands from the vaginal discharge to the eyes. Gonorrhœal arthritis is not common, but may affect the knee, ankle, wrist, or elbow. The symptoms of arthritis resemble those of ordinary rheumatism. Cystitis is extremely rare. Bubo is occasionally seen, and may be simple or suppurative. As already stated, the disease in many, probably in nearly all the severe cases, affects the lining of the uterus. Infection may extend from the uterus to the tubes and cause pyosalpinx, or even peritonitis. Sänger reports a case of pyosalpinx from gonorrhœal infection in a little girl of three years, and Huber a fatal case of peritonitis of similar origin in one of seven. I have myself seen one of severe pelvic peritonitis in a girl of seven. In all these cases the diagnosis of the gonorrhœal origin of the disease must rest upon the presence of gonococci in the vaginal discharge.

Treatment of Vulvo-Vaginitis.—The first thing is proper isolation, and care to prevent the spread of infection by means of clothing, linen, etc. In institutions, and in families where there are many children, the greatest care is necessary even in catarrhal cases.

Simple vaginal catarrh requires cleanliness, which is best secured by irrigating twice daily with a warm saturated solution of boric acid, or 1 to 10,000 bichloride. A pad of sterilized absorbent cotton, the meshes of which are filled with boric acid and starch, or iodoform, may be placed between the labia in the most severe cases, the patients being kept in bed. The skin should be protected by ointments. In obstinate cases, irrigation with astringent solutions, such as sulphate of zinc or tannic acid, may be used. More radical means are rarely required. Attention to the general condition of the patient must not be overlooked, and the health should be built up by iron, cod-liver oil, and other tonics. Every young child should wear a napkin, to prevent carrying the disease to the eyes by the hands.

In the *gonorrhœal cases* nothing is so efficient as the irrigation with the solutions above referred to. They should, however, be employed more frequently; in the early stage, where the secretion is abundant, as often as three or four times a day. In cases passing to the chronic stage, a solution of nitrate of silver, ten grains to the ounce, may be applied to the vagina through a speculum. This should be repeated every second or third day. In all circumstances these cases are tedious, and require the closest attention to detail to insure the best results. Relapses are not uncommon in cases which had apparently recovered.

HERPES OF THE VULVA.

This may occur on the cutaneous surface only, or there may be a herpetic condition of the mucous membrane. The skin of the perinæum may be involved, and the disease may extend quite to the anus. On the skin, the eruption runs the ordinary course of herpes elsewhere. Vesicles form and rupture or dry, forming crusts or leaving small ulcers, which heal in a week or ten days if the parts are simply protected. On the mucous membrane the vesicles are succeeded by small ulcers, which may coalesce and form larger ones, the appearance resembling the same condition in the mouth. The symptoms are itching, burning pain, and a slight discharge. The herpetic ulcer may be confounded with a mucous patch. These cases usually recover promptly if dusted with some absorb-

ent powder like boric acid ar
cleanliness should be secured.
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and the application of the actual

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Synonyms: Inconti

ENURESIS may be due to som
as an abnormal opening of the bla
the bladder, or to the persistence
urine is discharged from the um
eases of the central nervous syste
meningitis, tumours of the brain
juries of the cord. In many of t
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distinct from the ordinary form of
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variety which will be considered h

In early infancy, evacuation of
impulse is sent from the nerves of
reflex impulse from this centre pr
the detrusor urinæ and a suspen

sphincter. It is often possible to teach infants to control the evacuation of the bladder before the end of the first year; usually, however, control is not acquired even during waking hours until some time during the second year, and in some healthy infants not before the end of the second year. The time depends very much upon the training. If a child during its third year can not control the evacuation of the bladder during its waking hours, incontinence may be said to exist.

Etiology.—Incontinence of urine may be due to a continuance of the infantile condition, to anything which increases the irritability of the spinal centre, or which interferes with the cerebral control over this centre, or to anything which increases the irritability of the terminal filaments of the vesical nerves or of those in the neighbourhood, in consequence of which too many or too strong impulses are sent to the spinal centre. The causes of incontinence thus may be in the central nervous system, in the urine, in the bladder, or in any of the adjacent organs.

The causes relating to the central nervous system are in the main those of the other neuroses of childhood; these are anæmia, malnutrition, an inherited nervous constitution, or a condition of extreme nervousness or neurasthenia, the result of the child's surroundings. In such cases incontinence is often associated with chorea, epilepsy, hysteria, headaches, neuralgia, and other nervous symptoms. In these conditions there may be not only an increased irritability of the nerve centres, but also of the peripheral nerves, accompanied by loss of tone of the vesical sphincter. A similar condition may exist with almost any form of acute illness, usually, however, being only temporary.

The causes referable to the urine are chiefly a highly-acid urine, generally associated with lithuria. In such cases the incontinence is very often due more to the constitutional than the local condition.

In the bladder itself, cystitis and vesical calculus, although infrequent, should not be overlooked as possible causes. In a few cases, where incontinence has existed a long time, the bladder becomes so contracted that it will hold only an ounce or two of urine. This condition, although not the primary cause of enuresis, may be enough to continue it.

Local irritation in the neighbouring organs may be due to adherent prepuce, balanitis, phimosis, or to a narrow meatus. All of these conditions are frequently associated with incontinence. Rectal irritation may be caused by pinworms, anal fissure, or rectal polypus; and vaginal irritation by vulvo-vaginitis or adherent clitoris, both, however, being extremely rare. Often we have incontinence as the result of a combination of several causes, no one of which alone would have been sufficient to produce it. Thus, in a healthy child phimosis may give rise to no symptoms, while in one who is anæmic or neurasthenic it may produce enough local irritation to cause incontinence. In many cases heredity seems to be a factor of some importance, parents often having suffered in their childhood from the same disease; quite frequently there are seen two and sometimes even three children in the same family affected. In many cases the condition seems to be mainly the result of habit, and in all cases habit is a potent factor in continuing the incontinence, sometimes after the original exciting cause has been removed. Frequently no adequate cause can be found. Both sexes are about equally liable to enuresis, and it may be seen in all ages up to puberty.

Symptoms.—Enuresis may be nocturnal or diurnal, or both. Of 194 cases, 73 were nocturnal, 9 diurnal, and 102 were both nocturnal and diurnal. Cases differ greatly in severity. Incontinence may be habitual, occurring every night, often several times during the night, and frequently during the day; or it may be only occasional under the influence of some special exciting cause, where it continues a few days or weeks until the cause is removed. In a considerable number of cases, the condition lasts from infancy until the sixth or seventh year. It may even continue until puberty; but it generally ceases at that period, unless its cause is mechanical, or depends upon some organic disease of the brain or cord. In ordinary enuresis there is never dribbling of the urine, but usually a contraction of the walls of the bladder follows almost immediately upon the desire, before the patient can make his wants known or reach a convenient place for micturition. At night the same thing may occur without wakening the child, the contraction being of purely reflex origin.

Prognosis.—The condition is usually hopeless when it depends upon organic disease of the brain and cord; also in cases due to malformation, unless these are amenable to surgical treatment. In the ordinary cases seen, the prognosis depends upon the age of the child, the duration of the symptom, and the nature of the exciting cause. As a rule, it is better in children only four or five years old than in those of eight or nine, for the obvious reason that a case which has lasted to the latter age is usually an intractable one. If a cause can be discovered and if this is one that can be removed, the prognosis is much better than if no cause can be found. In the great majority of the cases a cure is possible, provided the patient can be held long enough to a regular plan of treatment. The treatment must in most cases be continued from three months to a year, and always for several months after the incontinence has ceased, on account of the strong tendency to relapses.

Treatment.—The first indication is to remove the cause, where one can be found. If there are preputial adhesions, they should be broken up and irritating smegma removed. If phimosis is present, it should be relieved by stretching or circumcision. A narrow meatus should be cut to proper dimensions. If stone in the bladder is suspected, as it should be when the incontinence is worse by day and accompanied by straining and painful spasm of the bladder, the patient should be sounded for stone. Pinworms in the rectum should receive the appropriate treatment by injections. A urine of high acidity, with deposits of uric acid, calls for alkalies and the free use of fluids, especially water. While the local conditions mentioned should always be attended to, the fact remains that few cases are cured simply by relieving them, except those due to vesical calculi. The explanation of this is that habit is so important a factor in keeping up incontinence where it has existed a long time. In most cases, therefore, we must depend upon general measures and drugs directed toward the relief of the symptom, either in conjunction with local treatment or alone.

Care should be taken to secure for the child a simple, natural life, preferably in the country. There should be no overtaxing of the nervous system at home or in school. Every cause of unnatural excitement should be avoided. Early hours and plenty of sleep must be insisted upon. Certain articles of diet are to be avoided, and coffee, tea, and beer should be absolutely prohibited. Sweets and all highly seasoned food should be very sparingly allowed, or not at all. Although it is believed by many that a diet into which meat enters largely is injurious, from personal experience I have not found the exclusion of meat to be of any advantage; nor is anything to be gained by limiting the amount of water which the child takes, except possibly in cases of nocturnal incontinence, where it is well to restrict the quantity taken late in the afternoon. When incontinence is associated with highly-acid urine, it is often aggravated by cutting down the fluids. The diet which succeeds best is a simple one composed of milk, vegetables, fruits, meats, and cereals. Punishments, whether corporal or otherwise, do no good, and are in most cases absolutely harmful. They should never be allowed. Rewards are much more effectual. The moral treatment of a case is important; it is well to work upon a child's pride, and use every means to strengthen his will. Where the incontinence is solely or chiefly at night, the child should be taught to hold his water as long as possible during the day, in order to accustom the bladder to full distention.

Measures which are directed toward the patient's general condition are quite as important as those employed for the control of the incontinence. Anæmia, chlorosis, malnutrition, indigestion, and constipation should each receive careful attention. Any local condition, such as adenoid growths of the pharynx, which might serve to increase the general nervous irritability, should be removed.

Of the drugs used for the purpose of affecting the incontinence, belladonna stands at the head of the list; but it must be given in full doses, usually sufficient to produce the physiological effects, and continued for a long time, in most cases for many months. Either the fluid extract or the alkaloid, atropine, should be employed. My preference is for the latter, because of its more uniform strength. A convenient method of administration is to use a solution of atropine, one grain to two ounces of water, of which one drop ($\frac{1}{1000}$ of a grain) may be given for each year of the child's age. For nocturnal incontinence this dose should at first be given at 4 and 10 P. M.; after a few days, at 4, 7, and 10 P. M. Usually this may be gradually increased until double the quantity is given. A child of five years would then be taking ten drops ($\frac{1}{100}$ of a grain) at each of the hours mentioned. I have rarely found it advisable to go above these doses. As the larger doses are reached the increase should be more gradual. When the condition is under control, or when the full physiological effects of the drug are produced, the same dose should be continued for some time and then reduced, the atropine being given for at least two months in gradually diminishing doses after the incontinence has ceased. This is very important if the cure is to be permanent, as there is so strong a tendency in these cases to relapse.*

Strychnine may be added in cases not yielding to the atropine alone. It is particularly advantageous when there is diurnal as well as nocturnal incontinence, for under these conditions there is usually a lack of tone in the sphincter, as well as increased irritability in the mucous membrane of the bladder. The initial dose for a child of five years should be $\frac{1}{100}$ of a grain twice daily; this may be gradually increased to $\frac{1}{50}$ of a grain three times a day; but there is rarely any advantage in pushing it further. Ergot is sometimes useful, but rarely gives relief when both strychnine and atropine have failed. The indications for its administration are the same as for strychnine, but it is objectionable for prolonged use on account of the disturbance of the stomach. Rhus aromatica, although inferior to the drugs already mentioned, possesses a certain amount of value, and may be tried in case the others fail. From three to twenty drops of the fluid extract should be given three times a day. Like strychnine, it is indicated in atonic cases. Of the other measures recommended, raising the foot of the bed at night to keep the urine away from the neck of the bladder, may give temporary relief, as may also some of the various contrivances for preventing the child from sleeping upon the back; but none of these are in any sense curative. Some obstinate cases have been relieved by galvanism, the positive pole being placed over the lumbar spine and the negative pole over the bladder. If there is reason to suspect a contracted bladder, as when the incontinence has lasted for years and the bladder will never hold more than an ounce or two of urine, cure is sometimes accomplished by daily distending the organ up to its normal capacity with warm water.

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* As an illustration of the success which may be obtained by this plan of treatment when faithfully carried out, our experience in the New York Infant Asylum may be cited. Twelve obstinate cases, in none of which could any local cause be found, were selected and treated by Dr. Kerley, then resident physician, in the manner indicated. After five months' treatment, seven of the cases were so much improved that incontinence rarely occurred. The atropine was, however, continued in smaller doses for four months longer, at the end of which time the cases were well. In the remaining five cases but little improvement was seen after five months' treatment, and not until the end of ten months could it be said that much improvement had occurred. In these cases the drug was continued for two months longer and all treatment discontinued, as the cases were cured. None of these had relapsed six months afterward. It was here of great advantage that the children were under close observation in an institution where the treatment could be continued. In dispensary and private practice the want of early success would no doubt have deterred mothers from continuing the medicine.

VESICAL SPASM.

This is quite a common condition, and often passes under the name of *genital irritation.* It is characterized by frequent, sometimes by difficult and painful, micturition. It occurs in children of all ages, even in infants, but is especially frequent between the ages of two and five years. This symptom has already been referred to in connection with uric-acid infarctions in very young infants.

The usual cause is the irritation of the bladder by a concentrated, highly-acid urine. It often results from cold; it may accompany acute febrile processes, and is sometimes merely a symptom of nervous irritability. The cause may thus be in the bladder or in the urine. It may be accompanied by enuresis, but usually occurs without it. It is sometimes symptomatic of disease in adjacent parts, as in the rectum or the pelvic peritonæum, or it may be associated with inflammation of the vulva or urethra. It is also one of the symptoms of vesical calculus.

The *symptoms* of vesical spasm are local only. The child passes water very frequently, often several times an hour. The accompanying pain may be intense, not infrequently sufficient to cause the child to cry out. Often there are pain and severe vesical tenesmus with the passage of only a few drops of urine at a time, but blood is not present. If the condition depends upon the character of the urine, or is only an expression of an extreme vesical irritability, the symptoms are generally of short duration, possibly a day or two. If it depends upon vesical calculus, it may be intermittent. If it is associated with disease of the adjacent pelvic viscera, it is inconstant, and may continue for a considerable period, depending upon the nature of the cause.

The *treatment*, in the ordinary cases, consists in the administration of an abundance of water, with alkaline diuretics, and either belladonna or hyoscyamus. The following formula is one that I have usually found efficient:

℞	Tincturæ hyoscyami	ʒ ss.
	Potassii citratis	ʒ j
	Aquæ destillat.	℥ ij

M. Sig.: Half a teaspoonful in water every hour to a child of two years.

If the cause is outside the bladder, it should receive appropriate treatment.

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SECTION VII.

DISEASES OF THE NERVOUS SYSTEM.

CHAPTER I.

INTRODUCTORY.

The Weight of the Brain.—From ninety-eight observations made in the post-mortem room of the New York Infant Asylum, the following were the average weights noted:

At three months	21 oz.	(602 grammes).
At six months	25½ "	(712 ").
At twelve months	32½ "	(916 ").
At two years	35 "	(990 ").

The following are the figures given by Boyd and Schäfer:*

AGE.	Males.		Females.	
	Ounces.	Grammes.	Ounces.	Grammes.
At birth (full term)	11½	330	10	283
Under three months	17½	493	16	451
From three to six months	21	602	20	560
From six to twelve months	27	776	26	727
From one to two years	33	941	30	843
From two to four years	39	1,095	35	990
From four to seven years	40	1,138	40	1,135
From seven to fourteen years	46	1,301	40½	1,154
From fourteen to twenty years	48½	1,374	44	1,244

At birth the weight of the brain to that of the body is nearly 1 : 8. During infancy and childhood the following is the ratio, according to Bischoff: during the first year, 1 : 6; the second year, 1 : 14; the third year, 1 : 18; at the fourteenth year, 1 : 15 to 1 : 25; in adults, 1 : 43.

The Spinal Cord.—The weight of the cord to the weight of the body at birth is 1 : 500; in adult life it is 1 : 1500. According to Kölliker, the spinal cord and the vertebral column are the same length until the end of the third month of fœtal life, there being at this time no cauda equina. At the ninth month the lower end of the cord is opposite the third lumbar vertebra; in the adult it is opposite the first.

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* Quoted by Sachs.

Some Peculiarities in the Diseases of the Nervous System in Infancy and Childhood.*—The relatively large size, the rapid growth, and the immaturity of the brain and cord during early life, explain much that is peculiar in the nervous diseases of this period.

At this time, apparently trivial causes are enough to produce quite profound nervous impressions, because of the instability of the nervous centres and the greater irritability of the motor, sensory, and vaso-motor nerves. These are conditions which are very much increased by all disturbances of nutrition. These disturbances may be manifold in character, but they lie at the root of very many of the neuroses of early life,—e. g., extreme nervousness, disorders of sleep, stuttering, chorea, incontinence of urine, tetany, and convulsions. The great liability to convulsions depends not only upon the greater irritability of the peripheral nerves, but on the instability of the nervous centres and the lack of inhibition over the motor ganglion cells of the spinal cord. The nervous centres are more easily exhausted than later in life. Prolonged or continuous overstrain from any cause whatsoever, frequently leads to headache and chorea, and sometimes even to epilepsy and insanity.

Another peculiarity is the serious consequences which often follow reflex irritation, although this is rarely the only factor in the case. Conditions which in adult life produce almost no effect may in infancy be the cause of most alarming symptoms. As a few examples may be cited, reflex symptoms due to phimosis, to intestinal worms, convulsions from disturbances of digestion, nervous symptoms due to eye-strain, or to adenoid growths of the pharynx. In the production of some of these, especially attacks of convulsions, there are several factors, such as the great irritability of the peripheral nerves, the instability of the nervous centres—often a result of disturbed nutrition, as in rickets—and the lack of inhibitory action of the cortex of the brain.

As a third point of importance may be mentioned the grave permanent results which often follow relatively small organic lesions. A good illustration is seen in the lesions which produce cerebral birth-palsy. Here the damage is only in small part the immediate effect of the hæmorrhage, for this often is not great, but it is the interference with the development of certain parts of the cortex that makes this condition so serious.

From what has been said, it follows that the hygiene of the nervous system is of the utmost importance in infancy and childhood. It is essential for the healthy development of the nervous system that all stimulants should be avoided,—not only tea, coffee, and alcohol, but undue and unnatural excitement, the effect of which in infancy is almost as serious. A normal development can take place only in the midst of quiet and peaceful surroundings, with plenty of time for rest and sleep. The conditions of modern life, especially in cities, are such that these laws are almost invariably violated, and the consequences of this are seen in the marked and steady increase in nervous diseases among children.

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* See Rachford; Some Physiological Factors in the Neuroses of Childhood. Cincinnati, 1895.

CHAPTER II.

GENERAL AND FUNCTIONAL NERVOUS DISEASES.

CONVULSIONS—ECLAMPSIA.

UNDER this head are included attacks of acute transient nervous disturbance, characterized by involuntary rhythmical spasm of the muscles, either of the face, trunk, or extremities, or all of them, usually accompanied by loss of consciousness. They may be regarded as "motor discharges" from the cortex of the brain.

Etiology.—The principal predisposing causes are infancy, conditions affecting the nutrition of the brain, and heredity influences. Of all these factors, the most important one is the instability of the nerve centres which is characteristic of infancy and is associated with the non-development of the voluntary centres of the cortex. The brain grows more during the first year than in all later life, and this rapidity of growth is in itself an important predisposing cause of functional derangement. After infancy, attacks of convulsions are much less frequent, and after seven years they are relatively rare. While convulsions occasionally occur in children previously healthy, the majority of attacks are in those in whom there is at least some disturbance of the nutrition of the brain,—the cerebral instability of infancy being greatly exaggerated by such nutritive disorders. The most frequent one is rickets, which may be regarded as altogether the most important predisposing cause of infantile convulsions. They are often one of the earliest symptoms of that disease, and where convulsions occur in infancy without evident cause, rickets should always be looked for. Any disturbance of nutrition may predispose to convulsions, such as exhaustion, anæmia, malnutrition, syphilis, and debility resulting from any acute disease, especially those of the digestive tract. Children who inherit from their parents a peculiarly nervous temperament are more liable to convulsions than are others. This predisposition is often seen in several members of the same family. Females are rather more frequently affected than males.

The exciting causes include a wide variety of pathological conditions, among which disturbances of digestion take the first place. Where the susceptibility is very great, the exciting cause may be a trivial one. These causes may be grouped under three general heads: (1) direct irritation of the cortex of the brain; (2) reflex irritation; (3) toxic influences.

Under the head of direct irritation may be included all convulsions occurring with the various forms of cerebral disease; the most frequent are meningitis, meningeal or cerebral hæmorrhage, tumour, abscess, hydrocephalus, embolism, and thrombosis. As examples of reflex irritation may be classed the convulsions following severe injuries, like compound fractures or burns, renal or intestinal colic, retention of urine, phimosis, a foreign body in the ear, or intestinal strangulation. A case has been related to me in which the application of cold to the skin repeatedly induced convulsions. Other conditions classed under this head are dentition and worms, but both must be regarded as exceedingly rare causes of convulsions. The exciting cause is very frequently the presence in the stomach or intestines of undigested food; such attacks are sometimes ascribed to reflex irritation, but the majority are better regarded as toxic. Acute and chronic indigestion are to be ranked among the most frequent causes of convulsions, both in infants and older children. In either there may be but one attack, or attacks may recur at intervals of a few months with a repetition of the cause. Of toxic origin may be considered not only the convulsions resulting from conditions like uræmia and asphyxia, but also those which occur at the onset or in the course of various infectious diseases, sometimes classed as febrile convulsions. They are very frequent at the onset of certain diseases, particularly pneumonia, scarlet fever, malaria, acute indigestion, and gastro-enteric infection; less frequently of measles, typhoid fever, ileo-colitis, and diphtheria. In these cases the convulsions seem due partly to the intensity of the poison and partly to the suddenness with which it affects the nervous system. Convulsions occurring late in the course of many diseases may be due to toxic influences, especially when associated with exhaustion of the nerve centres, from the prolonged disturbances of nutrition accompanying the febrile condition.

In pertussis—which, of all infectious diseases, is the one in which convulsions are most frequent—several factors may be present: asphyxia due to a severe paroxysm, cerebral congestion or hæmorrhage resulting from such a paroxysm, or simply from the peculiar susceptibility of the patient brought about by the disease itself.

Convulsions may be associated with enlargement of the thymus gland. I have notes of three cases of fatal convulsions where there was found at autopsy great enlargement of this body, which weighed from one to one and a half ounces. Two of these infants were previously healthy; one was rachitic. The similarity of all these cases convinced me that the convulsions were in some way due to the enlarged thymus, probably from pressure either upon the bronchi and lungs, or upon the pneumogastric (page 43).

There are some cases of convulsions for which no cause can be discovered even at autopsy, and for the present we must be content to class them as idiopathic. One attack of convulsions renders the patient more liable to a second, and where there have been several, they occur from causes which are less and less marked.

Pathology.—The "nervous discharge" which occurs in an attack of convulsions differs in no essential particulars from that of ordinary epilepsy. In the latter disease there is seen a tendency to recurrence with greater or less frequency, until the discharge may take place from very slight causes.

The part of the brain most intimately concerned in the production of convulsions is the cortex. Such attacks may be regarded as involuntary discharges of nerve force from the cortical motor centres, which result from direct irritation of these parts by disease; or from an irritation arising in some other part of the brain, as from the vaso-motor centres of the medulla; or from a reflex irritation in a distant part of the body. Convulsions may depend upon the fact that while nerve cells may be able to generate nerve force they can not control its discharge, as in the convulsions of rickets. An important element in the convulsions of infancy, according to Hughlings Jackson, is the lack of development of the higher cerebral functions, in consequence of which they do not exert the controlling influence over the discharge of nerve force which they do in later life.

The condition of the brain in the beginning of an attack of convulsions is one of anæmia; this is shortly followed by venous hyperæmia which may be very intense. In infants who die during convulsions the brain and its meninges are usually found intensely congested. They may be the seat of punctate hæmorrhages, and sometimes of more extensive ones. The lungs are also deeply congested, and the right heart is generally distended with dark clots. The other lesions found are accidental.

Symptoms.—In some cases prodromal symptoms are present, such as extreme restlessness, irritability, slight twitchings of the muscles of the face, hands, feet, or eyelids. More frequently, however, the attack comes quite suddenly with but momentary warning. Usually the first thing noticed is that the face is pale, the eyes fixed, sometimes rolled up in their orbits; in a moment or two convulsive twitchings begin in the muscles of the eye or face, or in one of the extremities, which usually rapidly extend until all parts of the body participate. In most cases the convulsions become general, but they may, however, remain unilateral even when not due to a local cause,—a point which is often forgotten. The contraction of the facial muscles causes a succession of grimaces; the neck is thrown back; the hands are clenched; the thumbs buried in the palms; and a quick spasmodic contraction of the extremities occurs. There may be some frothing at the mouth, and in all true convulsions there is loss of consciousness. Respiration is feeble, shallow, and may be spasmodic. The pulse is weak; ular. The forehead is covered pale, then becomes slightly bl rattling sounds may be produc tum may be evacuated. The c nation of flexion and extensi of tonic and clonic spasm ma The contractions of the two si After a variable time, from a fe movements are gradually less fre leaving the patient in a condi short time or there may be but tion usually follows the convul marked evidences of prostration. exhaustion of the nerve centres,

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due? To answer these questions a careful history must be obtained, and all the circumstances surrounding the patient, the character of the convulsions, and all the other symptoms present must be taken into consideration.

In infancy, epilepsy is certainly the least probable diagnosis. In older children the most important points indicating that disease are: the presence of some of the stigmata of degeneration (page 757), a history of previous attacks, a distinct aura preceding the seizure, or a sudden onset with a cry or fall, biting of the tongue, a tonic spasm preceding the clonic, and, finally, perfect recovery in the course of a few hours after the attack. Convulsions which come on with high fever, even though a patient may have repeated attacks, are seldom epileptic. However, in some cases only prolonged observation can enable one to decide positively whether or not epilepsy is present.

Convulsions occurring in brain disease, except acute meningitis, are not as a rule accompanied by any marked rise in temperature. Focal symptoms are often present, such as localized paralysis or rigidity, changes in the pupils, and strabismus. The convulsive movements are frequently limited to one side of the body. It should, however, be borne in mind that unilateral convulsions, even when repeated, do not always mean a local lesion, as I have seen proved by autopsy more than once. In hæmorrhage or meningitis, convulsions are likely soon to recur. In tumour they may recur after a longer interval.

Convulsions may be thought to indicate the onset of some acute disease when they occur in a child over two years old, and when they come on suddenly or with only slight premonition in a child previously well; but the most important point is that they are accompanied by a high temperature,—104° to 106° F. Acute meningitis is the only other condition likely to produce these symptoms. Whether the convulsions mark the onset of lobar pneumonia, scarlet fever, malaria, or some other disease, can be determined only by carefully watching the patient's symptoms for twenty-four or thirty-six hours.

In convulsions depending upon some disorder of the alimentary tract, one may get a history of chronic constipation, of improper feeding, and in nursing infants sometimes of passion, or even intoxication, in the wet-nurse. Convulsions are so frequently due to digestive derangements that the condition of these organs should be one of the first things to be looked into.

Examination of the urine should never be omitted in any case of convulsions of doubtful origin, even where no dropsy is present. This, both in infants and older children, is too often overlooked. Asphyxia may be suspected in the case of convulsions occurring in the newly born, late in pneumonia, in some cases of pertussis, in spasmodic or membranous laryngitis, or in laryngismus stridulus. Dentition and worms should be considered among the least probable, never as the most probable, causes of

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on convulsive movements when they have temporarily subsided. The patient should therefore be kept perfectly quiet, and every unnecessary disturbance avoided. Cold should be applied to the head—best by means of an ice cap or cold cloths—and dry heat and counter-irritation to the surface of the body and extremities. The time-honoured mustard bath causes so much disturbance of the patient that it may well be dispensed with and the mustard pack (page 52) substituted. The feet may be placed in mustard water while the child lies in its crib. The mustard pack and footbath should be continued until the skin is well reddened. The degree to which counter-irritation of the skin should be carried will depend upon the condition of the pulse and the cyanosis.

In controlling convulsions the three remedies which may be depended upon are the inhalation of chloroform, morphine hypodermically, and chloral by the rectum. Chloroform is undoubtedly the most reliable remedy for an immediate effect, and should be used even in the youngest infant. At the same time that it is being administered, chloral should be given *per rectum*. The initial dose should be, at six months, four grains; at one year, six grains; at two years, eight grains, dissolved in one ounce of warm milk. It should be injected high into the bowel through a catheter, and prevented from escaping by pressing the buttocks together. It may be repeated in an hour if necessary. The effect of the drug is generally obtained in twenty minutes. If, in spite of the chloral, the convulsions show a marked tendency to continue as soon as the chloroform is withdrawn, or if the enema of chloral has been expelled, morphine should be given hypodermically. Where the heart's action is weak, this is probably the best of all remedies. Objections are urged against it only by those who have had no experience with its use. To a well-grown child two years old, $\frac{1}{16}$ of a grain may be given; one year old, $\frac{1}{24}$ of a grain; six months old, $\frac{1}{48}$ of a grain. This dose may be repeated in half an hour if no effect is seen. The tolerance of opium in cases of convulsions is very marked, and sometimes double the doses mentioned may be required. The only other agent of much value is oxygen. I have seen convulsions which continued in spite of all other means, yield immediately to oxygen. This is most likely to be valuable in cases of convulsions due to asphyxia.

When once under control, the recurrence of the convulsions may be prevented by keeping the patient for two or three days under the influence of chloral with bromide of sodium, the amount of chloral being gradually reduced. If it is badly borne by the stomach and not easily retained by the rectum, either antipyrine or phenacetine may be used with the bromide. Where there is a strong tendency to recurrence of the convulsions, urethan is sometimes even more efficient than chloral. It may be given in the same or in slightly larger doses.

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associated with rickets may have been the first of the epileptic series. The first seizure is sometimes traceable to fright, great excitement, heat-stroke, or blows or falls upon the head even without any gross lesion. It may follow any of the acute diseases of childhood, particularly scarlet fever, rarely measles or typhoid. In none of these, however, is it often seen. As reflex causes may be mentioned intestinal worms, phimosis, adenoid vegetations of the pharynx, delayed or difficult menstruation, and masturbation. Most of these are rare causes, but they may be sufficient to produce the disease where a strong predisposition exists. Syphilis may be the cause of epilepsy even when there is no local disease of the brain.

Among the most important factors in producing a paroxysm, is intestinal putrefaction associated with chronic constipation and chronic intestinal indigestion. This subject has been lately investigated with great care by Herter and Smith,* who studied 238 specimens of urine from 31 epileptics. In 72 per cent of their observations there was unmistakable evidence of excessive intestinal putrefaction, as shown by the presence of ethereal sulphates in the urine in large amount, just before the occurrence of the paroxysm. The inference seems warranted that this intestinal condition was closely connected with the epileptic seizures. The statement of Haig, that there is an excessive elimination of uric acid preceding the paroxysm, was not borne out by the observations of Herter and Smith. The association of intestinal putrefaction with seizures of epilepsy is very important as furnishing a clew to the management of many of these cases. I believe it to be one of the most important etiological factors in cases occurring in children, particularly as an exciting cause of the first attacks.

Pathology.—It is not within the scope of this work to discuss the various theories which have been advanced. The following are the conclusions reached by Gowers: †

"The muscular spasm is to be regarded as the result of the sudden overaction (discharge) of nerve cells, the violent liberation of nerve force, and the sensations which the patient experiences before losing consciousness must be due directly or indirectly to the same cause. The disease which excites convulsions is most frequently at the cortex, and when organic disease causes convulsions that begin locally, the disease is almost invariably at the cortex. In idiopathic epilepsy the convulsions sometimes begin in this way, and this suggests very strongly that in such cases the change occurs in the cortex. Epilepsy must then be regarded as a disease of the gray matter, most frequently of the gray matter of the cortex."

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* New York Medical Journal, August and September, 1892.

† Diseases of the Nervous System, American ed. 1888, p. 1098.

While there is pretty general agreement that the seat of the morbid changes in true epilepsy are in the cortex, but little is yet definitely known as to the nature of these changes. Van Gieson has published* some very careful observations made upon portions of the cortex removed at a surgical operation from two epileptic patients. In one of these the disease was primarily due to a foreign body; in the other, to an old cicatrix. The conditions found represent the earlier changes of the disease, and were essentially the same in both cases. There were degenerative changes in certain of the ganglion cells, which in places had resulted in almost complete dissolution of these cells. In addition there was a distinct hyperplasia of the neuroglia tissue. Diffuse neuroglia sclerosis starting from the focus of disease has been reported by certain French writers—Marie, Féré, and Chaslin.

Symptoms.—Two distinct types of epileptic seizures are met with: the major attacks, or *grand mal*, in which there are severe convulsions lasting from two to ten minutes, with loss of consciousness, etc.; and minor attacks, or *petit mal*, in which the convulsive movements are slight and may be absent, and in which the loss of consciousness is often but momentary. Between these two extremes all gradations are seen.

Grand mal.—The onset may be sudden, without premonition, or it may be preceded by certain prodromal symptoms known as the aura. The aura may be motor, such as a local spasm of the hand, face, or leg; or sensory, such as numbness and tingling in any part of the body, or some abnormal sensation rising gradually to the head, at which time loss of consciousness occurs. The variety of sensations described by patients as indicating an attack is endless. There may be a sensation in one finger, in the face, tongue, eye, or in any part of the body; or the warning may be of a general character, like a tremor or a shivering sensation, or a feeling of faintness. There has also been described a visceral or pneumogastric aura, in which there is epigastric pain, sometimes nausea, and a sensation of a ball in the throat; or there may be palpitation, or cardiac distress. There may be general giddiness or vertigo, or a sensation of fulness in the head; or feelings of strangeness, or a dreamy, dazed condition; and, finally, the aura may have reference to any of the special senses, most frequently to sight. Sparks may appear before the eyes, or flashes of light or colour, or strange objects may be seen; or there may be a momentary loss of hearing; or strange sounds may be heard. In most cases the aura is peculiar to the individual, whose attacks are likely to be preceded by the same symptoms.

At the beginning of the seizure the face becomes pale, the pupils widely dilated, the eyes rolled up in their orbits and fixed. Speedily there is loss of consciousness. Simultaneously with these symptoms, or immediately following them, there occurs a violent tonic spasm to which are due the characteristic symptoms of the early part of the seizure—viz., the fall, cry, biting of the tongue, cyanosis, and evacuation of the bladder or rectum. The fall is forcible, violent; in fact, the patient is precipitated usually forward, and frequently suffers injury, never sinking down as in a faint. The head is often strongly rotated to one side. The position of the hands is that assumed in tetany. The cry is a hoarse, inarticulate sound, not very loud, and is due to forcible expiration, owing to spasm of the muscles of respiration with the glottis partly closed. The cyanosis is the result of tonic spasm of the muscles of respiration; it may be quite intense, so that the face is livid, bloated, and the features distorted. The spasm of the muscles of mastication causes the biting of the tongue. Evacuation of the bladder and rectum may result from contraction of their walls, or from spasm of the abdominal muscles. The violence of the muscular spasm in this stage may be very great; it has caused fracture of bones, rupture of muscles, and even dislocation of joints.

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* New York Medical Record, April 24, 1893.

The stage of tonic spasm may be only momentary, the patient passing almost at once into the stage of clonic convulsions. The usual duration is from ten seconds to half a minute. In the stage of clonic spasm which follows, the symptoms are those of an ordinary attack of convulsions. The muscular contractions are violent, and there is often frothing at the mouth. Gradually the muscles of respiration relax, air enters the chest, and the cyanosis passes off. After the clonic spasm has continued for a variable time—from two or three minutes to half an hour—the muscular contractions become less and less frequent, and finally cease altogether. In a few minutes the patient may regain consciousness, look vacantly around, and in a dazed way perhaps ask what has happened, he being completely oblivious to all that has occurred. More frequently, however, he passes at once into a deep sleep, which continues for an hour or more, but from which he can be aroused. From this he usually wakens with a severe headache, which may continue for several hours. After this he often feels better than for several days preceding the attack. During the seizure the temperature may be elevated one or two degrees, but rarely more. The attack may be followed by a slight temporary paresis, or aphasia, hysterical phenomena, vomiting, and intense hunger. In very rare cases the urine may contain a trace of sugar.

Petit mal.—The minor attacks of epilepsy may present a very great variety of symptoms, and at times it is almost impossible to decide that these are epileptic, except from their periodical occurrence. They pass under the names of "spells," "attacks of dizziness," "fainting turns," etc. The most striking thing which stamps them as epileptic is the loss of consciousness, and this may be of short duration, sometimes only momentary, and so pass unnoticed. In some cases it is absent altogether. There is no fall, but there may be a slight dropping of the head, a fixed stare for a

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Death rarely, if ever, results from epilepsy, except from some accident at the time of the seizures, or from the condition known as the *status epilepticus*; in this the attacks come on with great frequency and severity, the patient at times passing rapidly from one convulsion into another, the temperature rising to 105° or 106° F., and death occurring either from exhaustion, owing to the severity of the convulsions, or from coma.

Diagnosis.—In most cases there is little difficulty in recognising the major attacks when they occur by day. Nocturnal attacks may be diagnosticated by the cry, the biting of the tongue, blood upon the pillow, sub-conjunctival extravasation, evacuation of the bladder or rectum, and the severe headache. Minor attacks present the greatest difficulties, and a positive diagnosis is often impossible until the patient has been watched for a long time. The most important points to be noted are sudden pallor, dilatation of the pupils, temporary loss of consciousness, or simply mental confusion, and sometimes the evacuation of the bladder. The duration of the attack is shorter than is usual in an ordinary faint. The difficulty of distinguishing epilepsy from hysteria rarely occurs in childhood.

It is not always possible to distinguish between secondary or symptomatic epilepsy and the idiopathic or hereditary form, particularly if the case comes under observation late in the course of the disease. The points which go to establish the first form are: that the convulsive movements are partial, or limited to one side; that when they are general, they always begin in the same part of the body; or that there is a history of partial or unilateral attacks for some time before the occurrence of any general convulsions. It is important in all cases to examine the patient carefully for signs of an old hemiplegia, the symptoms of which may be so slight as to be readily overlooked. A marked increase in the reflexes of one side is, according to Sachs, quite as conclusive evidence as a distinct weakness of the arm or leg. In idiopathic epilepsy some of the stigmata of degeneration (page 758) are usually present. The sudden development of epileptic seizures in a child previously healthy, and in whom there is no hereditary history of the disease, should always arouse the suspicion of organic brain disease, especially tumour; and if there are besides, severe headache, vomiting, and optic neuritis, the existence of tumour is reasonably certain.

Prognosis.—The danger to life in epilepsy is very slight. Death is generally due to some accident, particularly drowning, at the time of a seizure. The tendency to spontaneous cessation of the attacks is small, while the tendency to recurrence is very great.

The prognosis in any given case depends upon the cause of the disease and the duration of the symptoms. Where the cause can be removed, and where the symptoms have lasted less than a year, the prospects of per-

manent cure are fairly good.
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Treatment.—The first indic
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associated with acute and chr
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and matzoon. Green vegetable
freely; also all fresh fruits. Te
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attention should be given to the
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pens that drugs are without any

treatment employed, whereas in conjunction with other measures marked improvement is seen.

The bromides are unquestionably the best means of combating the epileptic habit. Either the sodium salt alone or a combination of the sodium and ammonium bromides is to be preferred. The purpose should be to give the smallest doses which will control the seizures. Children require proportionately larger doses than adults, and in most cases a child of five years will need from twenty-five to fifty grains a day. Seguin's* method of administering the bromides is largely followed in New York, and is of great value. It is to give the larger part of the quantity for twenty-four hours, shortly before the time when the seizures have usually occurred; in the interval to give much smaller doses, and in all cases to give the dose largely diluted,—in from six to eight ounces of water. He gives a full dose early in the morning, and, where the seizures are apt to come at night, one at bedtime.

Cases of *petit mal* are especially difficult to control. For such there is often an advantage in combining belladonna with the bromides. In all cases the treatment must be continued for a long time if anything is accomplished. The bromide should be gradually reduced after the attacks are controlled, but must be given in moderately large doses for at least two years after the seizures have ceased. The addition of borax seems occasionally better than the bromides alone in cases where there is excessive intestinal putrefaction. Sometimes the combination of chloral or antipyrine with bromides is advantageous, particularly if the latter are badly borne or cause an annoying amount of acne. Seguin states that he has been able to control the acne in many cases by giving at the same time moderate doses of arsenic. Other drugs occasionally useful as adjuvants to the bromides are strychnine and digitalis.

The surgical treatment of epilepsy has of late attracted much attention. An operation is to be considered in cases in which the paroxysms are very frequent and severe, and when there is present a definite local cause, such as an old fracture of the skull, or where epilepsy has followed an injury to the head even without fracture. Sachs sums up the present status of this question as follows: "In a case due to a traumatic or organic lesion an early operation may prevent the development of cerebral sclerosis. If early operation is not done, the occurrence of epilepsy is a warning that secondary sclerosis has been established and an operation may prevent it from increasing. Operation must include the removal of the diseased area; here, if all other parts are normal, a cure may result. Under favourable conditions a few cases of epilepsy may be cured by surgery and many more improved."

The education of epileptic children is a subject of great difficulty and is often neglected. There are many reasons why it is impracticable to

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* New York Medical Journal, March 29, 1890.

send them to ordinary schools,
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Etiology.—While tetany may
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* American Journal of the

Pathology.—Up to the present time no constant anatomical lesions have been demonstrated in tetany. The circumstances in which it occurs, its symptoms and course, all indicate that it is a neurosis probably dependent upon disturbances of nutrition in the nerve cells of the spinal cord and medulla.

Symptoms.—The spasm may occur quite suddenly, or it may be preceded by various sensory disturbances, such as pain, numbness, or tingling. The upper extremities are usually first affected, the spasm gradually becoming more severe and finally involving the lower extremities. Both sides of the body are equally affected. The position assumed by the hands is very characteristic: The fingers are flexed at the metacarpophalangeal joint and the phalanges extended; the thumbs are adducted almost to the little finger; the wrist is flexed at an acute angle, and the whole hand drawn somewhat to the ulnar side (Fig. 108). No motion is allowed at the wrist, but movements at the elbow and shoulder are usually normal. The feet are strongly extended, sometimes in the position of typical equino-varus. The first phalanges of the toes are flexed, and the second and third rows extended; the plantar surface is strongly arched, and the dorsum of the foot is very prominent, standing out like a cushion. The typical position of the feet is well shown in the accompanying illustration. There are rigidity of the muscles of the calf and tension of the plantar fascia. The tendo-Achillis stands out prominently. Motion at the hip and knee is generally free. The spasm in many cases is limited to the hands and feet; more rarely the muscles of the thigh, usually the adductors, may be involved. I have seen three or four cases in which the spasm affected only the cervical muscles, producing marked opisthotonus. This form is generally mild, and may be associated with marasmus. In very rare cases the muscles of the trunk, the face, or the eye may be involved.

Where the spasm is intermittent, and in some cases where it has subsided, it may be excited by making pressure upon the large nerve trunks and arteries of the parts affected. This is known as "Trousseau's symptom," and is characteristic of the disease.

Pain owing to the spasm is frequently present. It is usually sharp and lancinating, and may be so severe as to cause children to cry out. Pain is induced by any attempt to overcome the spasm, and sometimes it is constant. Other disturbances of sensibility are even more common than pain. There is no loss of consciousness and no fever. The spasm is generally continuous, although there may be periods of remission or even of intermission. When associated with laryngismus stridulus, the spasm is much increased during these attacks. The electrical reactions are as a rule increased, and the knee-jerk and cutaneous reflexes are exaggerated.

The duration of the disease is from a few days to several weeks. The mild form, which is usually seen in infants, in most cases passes away spontaneously in one or two weeks, although there may be relapses and

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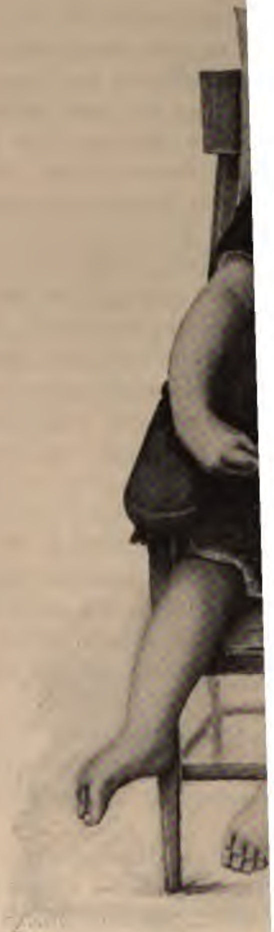

FIG. 108.—Tetany, showing the characte

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Diagnosis.—The diagnostic f
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rickets or some disorder of the intestines. The severe form may be mistaken for tetanus; but this is very rare except in the newly born; and trismus is the rule, and generally it is the first symptom. Trismus is extremely rare in tetany. From meningitis, tetany is distinguished by the absence of cerebral symptoms; from cerebral tumour, by the bilateral character of the spasm, the absence of headache and focal brain symptoms; from hæmorrhage, by the absence of cerebral symptoms; from malarial spasm, by the fact that it is constant, not intermittent.

Prognosis.—Tetany *per se* is not fatal, but death may result from the development of general convulsions or from the original disease which tetany complicates. Recovery is usually perfect, although Gowers states that in rare cases it has been followed by muscular atrophy.

Treatment.—The first indication is to remove the cause, and this in most cases is found in the digestive tract. If rickets is present it should receive the usual treatment, both dietetic and medicinal. If worms are suspected a vermifuge should be given. For the relief of the spasm, the hot bath is a most valuable remedy; friction may also be employed. Drugs which have the power of allaying spasm should be given,—chloral, bromides, and antipyrine. In the event of failure by these methods galvanism may be tried. After the attack the child's general nutrition should receive careful attention, to prevent relapses.

LARYNGISMUS STRIDULUS—SPASM OF THE GLOTTIS.

Idiopathic spasm of the glottis, or laryngismus stridulus, is a rather rare disease, and belongs especially to infancy. It is a pure neurosis, not often seen except in children who are rachitic. It is frequently associated with carpo-pedal spasm and with general convulsions. The disease is not to be confounded with ordinary spasmodic croup or catarrhal spasm of the larynx, which is of very frequent occurrence.

Spasm of the larynx may be seen in several conditions quite different from laryngismus stridulus. It forms one of the essential features of pertussis. It occurs both in infants and in older children from pressure upon, or irritation of, the pneumogastric or recurrent laryngeal nerve by a tumour in the mediastinum,—usually a tuberculous lymph node, or retro-œsophageal abscess. Reflex spasm of the larynx is also associated with enlarged tonsils, adenoid growths of the pharynx, and elongated uvula. There is a form of reflex spasm which occurs in the newly-born accompanied by crowing inspiration; this is not frequent, and is rarely serious.

Idiopathic spasm of the larynx is quite different from any of these. It is peculiar to infancy, the great proportion of cases occurring between the sixth and eighteenth months. Males appear to be more susceptible than females. The constitutional condition with which it is usually associated is rickets. In a large number of cases, but not in all, there is cranio-tabes. Many writers believe that laryngismus is invariably of rachitic origin. Of

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Pathology.—There are no
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Prognosis.—This is good, exc
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Diagnosis.—This is to be mad
The differential points have bee

(page 440). Owing to the occurrence of paroxysms and the crowing sounds, the disease may be mistaken for whooping-cough, and in fact this diagnosis is not infrequently made by parents. A careful examination of the patient during the attacks, the absence of cough, and the frequent association of tetany, are sufficient to differentiate this from pertussis.

Treatment.—During the attack the object is to break the spasm. In mild cases this may be done by sprinkling water in the face. In severe cases inhalations of chloroform may be required, and even intubation. Between the attacks the patient should be given either bromide and chloral, or antipyrine. Sodium bromide, gr. v, and chloral, gr. ij, may be given every three or four hours to a child a year old until the frequency and severity of the attacks are controlled; afterward three times a day. My recent experience with antipyrine in this disease leads me to the belief that it is more effective than bromide and chloral. When the symptoms are severe, two grains of antipyrine may be given every four hours to a child a year old, the dose being gradually diminished as the symptoms improve.

The general treatment of the child is quite as important as drugs directed toward relieving the spasm. Cold sponging should be used in every case unless it occasions so much fright as to increase the number of paroxysms. Careful attention should be given to the diet. Children should be kept in the open air as much as possible, and those who are rachitic should receive phosphorus. Cod-liver oil is needed in most cases. Any source of local irritation, such as enlarged tonsils, elongated uvula, or adenoid growths, should be removed; for, if not the actual cause of the attack, they may be the means of aggravating the symptoms. In all cases the treatment should be continued for several weeks after the paroxysms have subsided.

CHOREA—SAINT VITUS'S DANCE.

Chorea is a functional nervous disease characterized by aimless, irregular movements of any or all the voluntary muscles. Choreic movements are of a somewhat spasmodic character, often accompanied by an apparent or real loss of power in the groups of muscles affected, and by a mental condition of extreme irritability.

Etiology.—Chorea is most frequently seen between the ages of seven and fourteen years. Of 146 cases, 6 were under five years, 72 between five and nine years, and 68 between ten and fourteen years. The youngest case of which I have record was that of a child four years old. It is extremely rare before the third year, although it may occur even in infancy, and in a few recorded cases it was undoubtedly congenital. My own observations coincide with those of nearly all writers, that the disease is more than twice as frequent in females as in males. While chorea may be seen

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by all the symptoms above noted,
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There are, however, many others

My associate, Dr. F. M. Cran
treated by us at the New York P
ing results: Of 111 cases in whic
tigated there was a definite history
before the chorea; in 13, the first
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concurrent rheumatism in 24 per
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In the above statistics only arti

evidence of rheumatism. If the cases of endocarditis without articular symptoms were included, as I think they might fairly be, it would raise the proportion of rheumatic cases still higher. The great proportion of cardiac murmurs persisting after chorea, if not all of them, should, I believe, be classed as rheumatic, even if no articular symptoms have been present.

Overpressure in school is often an important factor in the production of chorea, as has been shown by Sturges (London). Anæmia, if not an essential factor, is certainly a very important one, and the great proportion of cases present very distinct evidences of it. Chorea may develop as a sequel of any of the infectious diseases, more particularly scarlet and typhoid fevers. It is seen quite often in cases of chronic malarial poisoning. Among the reflex causes may be mentioned phimosis, either lumbricoids or pinworms, delayed menstruation, and ocular defects,—although the latter more frequently cause a local spasm of the muscles of the eyes, which can hardly be considered choreic. It has been claimed that chorea may result from the reflex irritation arising from adenoids of the pharynx and enlarged tonsils. Whether this is directly or only indirectly a cause is not evident. The association of the two conditions is not very infrequent.

Hereditary influence is of considerable importance in the production of chorea. It is much more frequent in children of neurotic families, and very often several successive generations, or several children in the same family, may suffer from the disease.

The exciting cause of chorea in a certain proportion of cases is fright; occasionally it arises from imitation, and the disease has been known to occur epidemically in institutions. Choreiform movements may follow hemiplegia. Chorea and epilepsy may be associated in the same patient, or one disease may follow the other.

The causes which underlie the occurrence of chorea therefore, seem to be a rheumatic diathesis, a neurotic constitution, anæmia, and some severe disturbance of general nutrition. When these predisposing factors are present, an attack may be induced by many things. The greater the predisposition the less important may be the exciting cause. A very large number of the cases of chorea are in persons who present distinct evidences of rheumatism, although the explanation of this relationship is nct yet understood. In another group the neurotic element predominates, and in these there may be no connection whatever with rheumatism.

Pathology.—The exact pathology of chorea is at the present time not settled. The seat of the morbid process is undoubtedly the central nervous system, probably the motor areas of the cortex. Like epilepsy, chorea may follow organic brain disease, especially hemiplegia from cortical lesions. In some severe cases which were fatal, owing to association with acute endocarditis, capillary emboli have been found in the

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Symptoms.—An attack of c
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due to inability properly to control the movements of the tongue and lips, to a condition in which speech is almost impossible. In rare cases speech has been temporarily lost. Heart murmurs are frequent in chorea. Some of these are of anæmic origin, some possibly are due to chorea of the heart-muscle itself—although this is a matter of some uncertainty—but a large number, probably the majority, are due to concurrent endocarditis, as is shown by the fact that they are permanent, and are followed by all the signs of organic heart disease. During every attack the heart should be closely watched, especially in children in whom there is a strong predisposition to rheumatism.

The urine in chorea has recently been studied with care by Herter and Smith, who have shown that in very many cases there is an excessive elimination of uric acid. This is neither the cause nor the effect of the chorea, but is to be regarded as evidence of a profound disturbance of nutrition, of which the choreic movements are but another manifestation.* The general condition of choreic patients is usually much below normal. They are anæmic; the appetite is poor, often capricious; they sleep very badly; they suffer frequently from headaches; they are easily fatigued by slight muscular exertion; and in short they have all the symptoms of a greatly disturbed nutrition.

Course and Duration.—The ordinary form of chorea tends to spontaneous recovery in from six to ten weeks. Exceptionally it may last for three or four months. In a small number of cases the disease may become chronic and continue indefinitely. Certain forms of local spasm, particularly choreiform movements of the muscles of the face, eyes, or neck, may be permanent. In any case of chorea which lasts longer than the usual time, the patient should be carefully examined for some cause of peripheral irritation. The tendency to relapses and second attacks is very marked. Later attacks are likely to occur in the spring succeeding the first illness, and in a small number of patients attacks may come every year for four or five years.

Diagnosis.—There is little difficulty in recognising chorea from the sudden, irregular, spasmodic contraction of the muscles coming on under the circumstances indicated. No other movements of childhood are likely to be confounded with it. The form of chorea following hemiplegia is usually more athetoid than choreic, yet at times it closely simulates ordinary chorea. The difficulty in distinguishing between the two is often increased by the fact that the weakness of simple chorea may, if unilateral, closely simulate hemiplegia. The existence of rigidity, contractions, and increased reflexes belongs exclusively to hemiplegic cases, and these will usually suffice to clear up all doubt with reference to the diagnosis.

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* Dr. Herter has called my attention to the fact that in many cases of well-marked chorea the urine contains a peculiar reddish colouring matter called hæmato-porphyrin. This is also found in many cases of rheumatism, another evidence of the close relationship existing between these two diseases.

Prognosis.—As a rule this is favourable, and complete recovery can be predicted, the exceptions to this being few in number. Parents should always be warned of the tendency of the disease to return in succeeding years, and the fact should be stated that in a certain proportion of cases the disease may be permanent. The prognosis of the cardiac murmurs occurring in chorea should always be guarded, although some of these are functional and disappear with recovery from the chorea; but the number of those which do not disappear is sufficiently large to make one always apprehensive as to the ultimate result. Acute chorea accompanied with endocarditis may be fatal; a number of such cases are on record in which there has been no other evidence of rheumatism.

Treatment.—The general management of the case is equally important with the administration of drugs. A child with chorea should at once be taken from school, and should never be subjected to punishment or to ridicule on account of the movements. Special attention should be given to the patient's diet and general nutrition. Tonics, especially iron, are indicated in most cases. The food should be simple and nutritious, and all stimulants, particularly tea and coffee, should be absolutely prohibited. While fresh air is desirable, exercise should be prescribed with great caution and its effect should be carefully watched. It should never be carried beyond the point of slight fatigue. A certain amount of moral restraint is absolutely necessary; thus it often happens that choreic patients do very badly at home where they are indulged and receive sympathy, while in a hospital, where they are under restraint and made to control themselves, they begin to improve immediately. Gymnastics, although useful in some of the milder cases, may do positive harm in those which are severe. They should be regularly and systematically practised twice a day, but not continued too long. In all severe cases the "rest treatment" should be employed, and equal benefit is also seen in the milder ones,—the patient is put to bed, and complete mental and physical rest secured. This may be combined with gentle massage for fifteen or twenty minutes a day. The daily use of warm baths, either alone or in conjunction with massage, is decidedly beneficial. In other cases the regular use of cold sponging is of the greatest value.

With reference to the use of drugs, it is advisable to separate from other cases those in which the connection with rheumatism is very close. In the rheumatic cases, salicylate of soda is often efficient, while the drugs usually employed may be absolutely without effect. In a case recently under observation, arsenic had been continued for two weeks without the slightest improvement, when the patient had an intercurrent attack of subacute rheumatism for which salicylate of soda in full doses was given, with the effect of controlling the choreic symptoms promptly and permanently. In the non-rheumatic cases, arsenic is almost universally admitted to be the most valuable remedy we possess. The method of administration is important; failure most frequently results from the use of too small doses. Beginning with four drops of Fowler's solution three times a day for a child of eight years, the daily quantity may be increased by two drops each day until a disturbance of the stomach or bowels is produced, with puffiness under the eyes. The drug should now be stopped for two or three days, and then the same doses resumed and gradually increased, usually up to twelve drops three times a day, sometimes to fifteen, and even twenty drops, unless the movements cease before that time; but when this occurs the drug should be stopped. Arsenic should always be given after meals, and largely diluted, the dose being taken in a full glass of water, but not necessarily drunk at one time. The possibility of arsenical poisoning should be remembered, although it is extremely rare. Semple has reported a case in which multiple neuritis and general pigmentation of the skin occurred after four weeks' administration of the drug.

In the event of the failure of arsenic alone, it should be combined with the rest treatment. Drugs which sometimes succeed where arsenic fails are antipyrine and strychnine. From twenty to thirty grains of antipyrine should be given daily in divided doses to a child of eight years. There are a certain number of cases in which striking improvement follows the use of this drug if given in the full doses mentioned. To a child of eight years strychnine should be given in doses of $\frac{1}{60}$ of a grain three times a day, the dose being gradually increased until double this quantity is given; sometimes even larger doses than these are well borne. Galvanism is of some value in cases not relieved by drugs. Acute chorea of great severity may require opium, bromide and chloral, or even chloroform.

In estimating the value of drugs in the treatment of chorea, the natural course of the disease should be kept in mind, since those drugs which are taken after the third or fourth week are much more likely to be thought beneficial than those used in the early period of the attack.

There is no doubt that chorea may be dependent upon some ocular defect, and a correction of this will then form an essential part of the treatment, although few, if any, cases are cured by attention to the eyes alone.

Chorea has a strong tendency to recur, especially in the spring of the year. Children who have had one attack should be closely watched, particularly with reference to their work in school. They should not be crowded in their studies, they should have long vacations, and the nervous system should not be put upon any severe tension for a long time.

OTHER SPASMODIC AFFECTIONS.

Habit Spasm.—This term was, I think, first suggested by Gowers, to describe certain muscular movements of a spasmodic character which at first are only occasionally noticed, but which sometimes persist until they become habitual and almost entirely involuntary. The condition was previously called "habit chorea" by Weir Mitchell. The movements usually affect the muscles of the face, but they may be seen in almost any part of the body. The most frequent varieties consist of blinking or sudden frowning, raising the eyebrows, or some peculiar grimace. At other times there is sudden twisting of the head, shrugging of the shoulders, or jerking of the hands. It is not often seen in the leg, but the muscles of respiration are quite frequently affected. There may be a half-sigh, a sort of sob, or a peculiar dry, laryngeal cough.

These movements are at first only occasional; but as the habit becomes more firmly fixed the spasm recurs every few minutes, and in severe cases it may be almost continuous. In nearly all cases it increases by observation. The same form of spasm does not always continue, but after a time one may subside and another take its place. The condition may last for months or years, and it may even be permanent.

The causes are those of neuroses in general. In the beginning, at least, there is usually a somewhat depreciated general health. The patients are nervous children of neurotic antecedents. There may be a history of some definite exciting cause, such as illness or overwork in school. The spasm of the muscles about the eyes may be associated with pathological conditions of these organs. This may be enough to start the spasm, if not to continue it. Both sexes are affected. In boys, masturbation may sometimes be an exciting cause.

Habit spasm is to be differentiated from chorea: this is usually easy, from the limitation of the movements to one part or group of muscles and from the duration of the disease.

Treatment is quite unsatisfactory after the habit has become fixed, hence it is of the utmost importance that it should be arrested at the earliest possible age. Punishments are of no avail, and usually aggravate the condition. Rewards are much more effectual. The general health should receive attention and nerve tonics should be given, especially strychnine.

Athetosis and Athetoid Movements.—This term, introduced by Hammond, is used to describe a chronic form of spasm usually seen in the hand, but sometimes also in the foot, and even the face. It may affect both sides, but in most cases it is unilateral. The movement is slow, irregular, and inco-ordinate—a sort of "mobile spasm," as it has been called—and there may be associated a certain amount of muscular rigidity. Such movements may occur in persons otherwise healthy, but are usually seen as a sequel of cerebral palsies, generally hemiplegia. Recovery from the hemiplegia may be so nearly complete that the athetoid movements are looked upon as primary. In some cases the movements are more rapid and somewhat resemble those of chorea,—a condition which is sometimes classed as *post-hemiplegic chorea.* Athetosis is not influenced by treatment.

Rotary and Nodding Spasm of the Head.—These are rare forms of irregular movements usually observed in infancy. The condition was described long ago by Henoch, and since then cases have been reported by Hadden,[*] Peterson, and others. The most frequent is the rotary spasm, which consists in a side-to-side oscillation of the head, which may be slow or rapid, and in some cases is almost continuous. Some children have at times the nodding spasm also, and in others this is the only movement seen. Nystagmus is frequently associated, and may be of one or both sides. In a few of the reported cases convergent strabismus was present.

The causes of the condition are extremely obscure. It is usually seen in infancy between the third and eighteenth months, and, like most nervous symptoms of this period, has been ascribed to dentition, but without any special reason. In three of the cases reported by Hadden, it followed an injury to the head, and might perhaps be regarded as a result of cerebral concussion.

As a rule, the condition lasts for several months and improves,—in fact, recovery generally occurs. The prognosis is then usually favourable. In most of the reported cases improvement has followed the use of bromides; from ten to twelve grains daily should be given.

Nystagmus.—This term is applied to rhythmical, involuntary, oscillatory movements usually of both eyes. They are caused by the alternate contraction of opposing muscles. Nystagmus may be either vertical or horizontal. It is most often seen in infants a few months old, and is a symptom of irritation which may be general or local. In some cases the movement is almost continuous, occurring even in sleep; in others, it is only noticed at times of special excitement.

The etiology of nystagmus is obscure, and it may occur in quite a variety of conditions,—sometimes referable to the eye, at other times to the central nervous system. On the part of the eye, nystagmus may be due to blindness from any cause, to congenital cataract, corneal opacity, disease of the choroid or retina, or to errors of refraction. It may be seen in almost any organic disease of the nervous system, both with focal and diffuse lesions, especially in chronic hydrocephalus, insular sclerosis, tuberculous meningitis, and in diseases in which sight is impaired. Nystagmus may be of reflex origin, as in a case recently occurring in the Babies' Hospital, where an infant with a severe diarrhœa had repeated attacks, which disappeared each time after intestinal irrigation. While it is of no importance as a localizing symptom, nystagmus usually indicates something more than functional disturbance. An exception to this may perhaps be made when it follows cerebral concussion. In such cases it is usually temporary, disappearing in a few days or weeks. Under most other conditions it may continue indefinitely.

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[*] Lancet, June 14, 1890.

The condition of the eyes should be investigated in every case of nystagmus; it is only when the cause is here, and can be removed, that habitual nystagmus is amenable to treatment.

Hiccough (Singultus).—This is a spasm of the diaphragm which is usually seen in young infants. In them it is in most cases due to some irritation in the stomach. It is seen after eating, and may depend upon overfilling of the stomach by food, swallowing of air, etc. In other cases it has no relation to the taking of food, and is to be regarded as a form of reflex spasm, which may occur from a variety of causes, such as cold feet, chilling of the surface during bath, or suddenly taking an infant from a warm bed into a cold room. In cases like the above, hiccough, though sometimes annoying, is of little importance. It may be associated with gastric indigestion, with intestinal flatulence or inflammation, with peritonitis or intestinal obstruction. With the last two conditions it is always an unfavourable symptom. In older children hiccough sometimes occurs as a pure neurosis.

The object of treatment is to remove the cause. In infants this is to aid in the expulsion of the gas from the stomach by manipulation, position, or the other means useful in gastric colic. Where it is a nervous symptom only, it may be arrested by holding the breath, prolonged forced expiration, as in blowing a trumpet, and sometimes may require the use of such drugs as control muscular spasm—e. g., antipyrine or chloral.

Thomsen's Disease (Congenital Myotonia).—This rare disease is usually congenital. It may occur in several members of the same family, and is often hereditary. The characteristic symptoms are a peculiar rigidity of the muscles which is observed when they are first brought into action after repose. This rigidity is spasmodic, and usually continues but a few moments. It may recur when voluntary movements are again attempted. If, however, muscular effort is persisted in, it soon passes off. It is increased by apprehension, excitement, or cold, and by observation. The legs are most frequently affected, the condition being often noticed when the patient starts to walk; any of the voluntary muscles, however, may be involved. It may be greater upon one side of the body than upon the other. The muscles are abnormally sensitive to mechanical stimulation, and often to galvanism. They are above normal size, and the fibres themselves are enlarged.

The pathology of this disease is, according to Gowers, an altered functional condition of the muscle fibres, and an abnormal functional state of the nerve cells of the cord and the cortex. It is incurable, although the symptoms may be improved by active muscular exercise.

Cervical Opisthotonus.—This is usually a symptom of disease at the base of the brain, occurring with simple, tuberculous, and chronic basilar meningitis, sometimes with tumours of the posterior fossa of the skull. However, in certain cases it occurs as a form of reflex spasm, particularly in young infants who are suffering from diarrhœal diseases or marasmus. In these cases it may last for days or weeks. The deformity is produced by a contraction of the superior fibres of the trapezius and by the posterior group of cervical muscles.

Torticollis—Wry-Neck.—Torticollis is usually produced by a tonic spasm of one sterno-mastoid muscle, with which may be associated spasm of the posterior cervical muscles, including the trapezius. In recent cases there is simply a condition of muscular spasm; in those of long standing there may be permanent shortening of the affected muscle, atrophy, and partial paralysis. A somewhat similar deformity may be caused by cicatricial contraction of the tissues of the neck following burns.

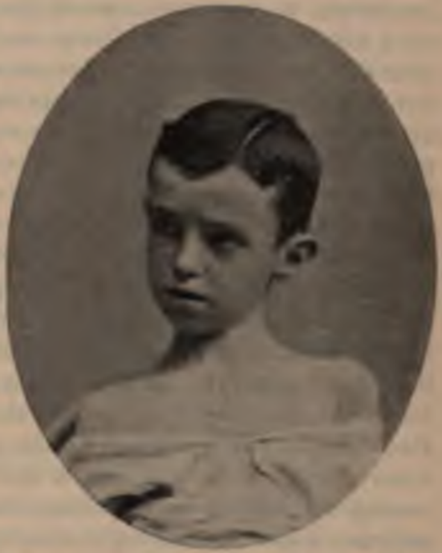
FIG. 109.—Spasmodic torticollis from malaria. Trapezius and sterno-mastoid of the left side are affected.

The deformity varies somewhat according as the sterno-mastoid muscle is alone affected, or the posterior muscles also, and as to which predominates. In simple sterno-mastoid spasm the head is inclined to the affected side and rotated toward the opposite side; the chin is raised, and the ear approaches the clavicle. When other muscles are involved the deformity is modified. If the trapezius is affected (Fig. 109) there is less rotation of the head, but it is drawn to the affected side and somewhat backward, while the shoulder is raised and the spine curved. Both of these symptoms may be seen to a slight degree in almost any marked case of sterno-mastoid spasm. Sometimes the spasm of the posterior muscles affects both sides; the head is then drawn backward and held rigidly but without rotation. In most of the recent cases the deformity can be partially or entirely overcome by passive force; but after a time this is impossible, owing to muscular shortening. In recent cases also localized pain and tenderness are frequently present, and sometimes they are severe.

Etiology.—Spasmodic torticollis may be produced by anything causing irritation of the trunk or the branches of the spinal accessory nerve; the source may be in the spinal canal, in the cranium, along the course of the nerve trunk, or of any of its peripheral fibres.

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* Observations upon Torticoll

formity, if untreated, to persist, and even to increase. If it has lasted several months the probabilities of spontaneous recovery or even of improvement are small.

Treatment.—The first indication is to remove or treat the cause where one can be found. Malarial cases require quinine; rheumatic cases are benefited by rest in bed, hot applications, counter-irritation, friction, and sometimes by anti-rheumatic remedies. Cases which have lasted a month usually require some orthopædic head-support, and those which have lasted six months or more are rarely cured without a surgical operation. This may be either a subcutaneous tenotomy or myotomy of the sterno-mastoid, or an open incision. Whitman gives the result of thirty-two cases admitted for treatment to the hospital mentioned, as follows: In 17 in which the deformity had lasted less than six months, 10 were cured, the average duration of treatment being three months; 4 were improved, and 3 not improved, the average duration of treatment in these cases being eleven months. Of 15 cases in which the deformity had lasted over six months, none were cured and only 6 improved, after an average of about eight months' treatment. In the foregoing series of cases the treatment consisted mainly in the use of orthopædic apparatus; later results from incision have been considerably more favourable. But these figures show how serious a matter is an old case of torticollis, and emphasize the importance of resorting to efficient measures early in the disease.

HYSTERIA.

This is not a disease of childhood, but one which is occasionally seen in early life. All that will be attempted in this chapter is to point out the most common manifestations of hysteria when it occurs in young children. After puberty it is essentially the same as in adults.*

Etiology.—Hysteria is very rare before the seventh or eighth year, and most of the cases seen in children occur after the tenth year. As to sex, there is no such predominance of females as in later life, although even in childhood they are more frequently affected than males. Hereditary influences play an important part in the production of this disease. It is seen in children who inherit a nervous constitution, or in whose parents nervous diseases, such as insanity, or hysteria, or alcoholism have been present. Of the other etiological factors the most important are a disordered nutrition, frequently with anæmia or chlorosis, and overpressure in schools. Masturbation or phimosis may act as an exciting cause, or, indeed, anything which leads to an exalted nervous irritability and depreciation of the general health. It is occasionally associated with tuber-

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* For a fuller discussion of this subject, and references to recent literature, see Mills, in Keating's Cyclopædia, vol. iv.

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1. *Psychical symptoms.*—W
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about which they have read.

2. *Sensory symptoms.*—These
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are affected, giving rise to hysteric
duration.

3. *Joint symptoms.*—These are
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* Gibney, Transactions of the Ameri
Archives of Medicine, New York, Decem

referred to the hip, and next to the knee, the ankle, or the spine. The pain is often acute. It is increased by motion, and by attempts at overcoming the deformity, if any is present. There is a marked hyperæsthesia of the whole limb, and sometimes of the body. In nearly every case there is marked tenderness of the spine upon pressure, especially in the dorsal region. The deformity may be very slight from spasm of the flexors only, or it may be severe, and followed by contracture, so that the thighs may be flexed tightly against the abdomen with the heels against the buttocks. Such deformities may last for months. There may be considerable muscular atrophy, but only that which comes from disuse. A special difficulty in diagnosis arises from the circumstance that these symptoms occasionally follow an injury.

Organic disease of bones and joints may usually be excluded by attention to the following points: The mode of onset is more abrupt than is seen in bone disease, and the course of the disease is quite irregular. The degree of deformity is greater than is seen in bone disease of the same duration. There are general hyperæsthesia of the limb, acute tenderness of the spine upon pressure, and undue sensitiveness to heat or cold. The deformity varies from time to time, being always more marked when examination is attempted. If the patients are closely watched, other evidences of hysteria may be seen. Under complete anæsthesia the contractures may disappear entirely. There is no enlargement of the articular ends of the bones, no swelling of the soft parts, and no evidence of active inflammation or of suppuration. All the symptoms except the deformity are subjective. Under proper treatment there is in most cases perfect recovery, often in a surprisingly short time.

4. *Motor and convulsive symptoms.*—In the milder forms we may see many varieties of tonic or clonic spasm. There may be seen local spasm of the eyes, face, or mouth, spasm of the muscles of the neck producing torticollis, of the muscles of respiration causing dyspnœa, which may be constant or paroxysmal. There may be hiccough, or spasm of the larynx causing hysterical aphonia. A very common symptom is hysterical cough, which may be so frequent and so severe—even accompanied by hæmoptysis—that grave disease of the lungs is suspected; the chest, however, is free from the physical signs of disease. There may be frequent attacks of vomiting with eructations; these may be continued sometimes even for months, and in rare instances blood has been vomited. There may be dysphagia from spasm of the œsophagus, or regurgitation of food on attempts at swallowing. In more severe cases we may have the symptoms of chorea major and attacks of hystero-epilepsy. The latter are rare in children and do not differ essentially from such attacks in older patients. There are usually prodromal symptoms. The convulsive movements are exceedingly varied in type. There are painful sensations and sensitive areas, by pressure upon which hysterical symptoms may be in-

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Diagnosis.—Hysteria is apt t
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cal mother, when this is possible.

In the general management of a case of hysteria, it is of the first importance that the child should be cared for by a person of firmness, who can exercise proper control. Hysterical children are always managed more easily when they are removed from their homes and placed under the charge of a good trained-nurse. Isolation is absolutely essential in many cases. The general health should be carefully looked after, and arsenic, iron, cod-liver oil, and other tonics given according to indications. Horseback exercise and other out-of-door sports should be encouraged, and every means taken to interest the child in something which requires physical exercise. In cases of simulated disease, the child should be put to bed, no books or toys allowed, and no effort made toward his amusement. No sympathy should be exhibited, but the child treated with kindness and firmness. This moral treatment is quite as important as any other part of the therapeutics. In cases with hysterical joint symptoms the most valuable thing is counter-irritation to the spine, preferably by the Paquelin cautery. Some cases are benefitted by galvanism. The moral effect of hypodermics, even of cold water, is sometimes striking. Under no circumstances should mechanical force be used to overcome deformity. Many cases of hysteria improve under hydrotherapy; the cold douche, the cold pack, or the shower bath may be used. This is valuable in conjunction with massage and the "rest treatment."

In attacks of hystero-epilepsy the cold douche may be used, or pressure made upon the testicle or ovary. In severe cases ether may be given. In all hysterical cases the condition of the bowels should receive careful attention, as these patients are very prone to obstinate constipation.

HEADACHES.

Headaches are not common in little children except in connection with disease of the brain or meninges; in older children they occur from causes similar to those seen in adult life. The most frequent headaches may be grouped in the following classes:

1. *Toxic headaches.*—Such are the headaches resulting from uræmia, from carbonic acid in poorly ventilated rooms, and from malaria. But the largest number are due to absorption of toxines from the intestines, and are associated with chronic indigestion and constipation.

2. *Headaches from anæmia and malnutrition.*—These are most frequently seen in girls from ten to fourteen years old. Some are intellectually bright, and have been crowded in their school work; others are dull and learn only with difficulty, and in consequence worry over their work until their health becomes undermined. They sleep badly, lose appetite, and often become choreic. The anæmia may be either the cause or the result of these symptoms. The urine in these cases often contains a large excess of uric acid.

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tomatic of organic disease of the
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4. *Headaches due to disease o*
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6. *Disturbances of the genital*
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Diagnosis.—The diagnosis of h
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DISORDER

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* See Wyllie, Edinburgh M

forms are much more frequent in boys than in girls, the proportion being more than four to one.

Stuttering.—This is the most common form of speech disturbance. Articulation is distinct and the separate sounds are properly produced, but there is a difficulty in connecting the consonant with the succeeding vowel; this seems like an obstacle to be overcome. Stuttering is occasionally seen in most children. It is more frequent in the third and fourth years, before speech is thoroughly mastered. At this age it is aggravated or produced by disturbances of nutrition, but is usually of temporary duration, lasting for a few weeks or months. Only recently a little boy of four was under my care, who became very anæmic, slept poorly, and suffered from malnutrition as a result of the confinement incident to a home in the city. He soon began to stutter, and in a short time it became painfully marked. After a few weeks in the country he improved very much in his general condition, gained four or five pounds in weight, and his stuttering completely, and I think permanently, disappeared. Such disturbances as this are analogous to chorea. In other cases stuttering follows some acute illness, and under such conditions also it is usually of short duration.

Most children who become habitual stutterers do not begin until they are six or seven years old, and sometimes even later. Stuttering may arise from imitation, and probably inheritance is an occasional factor. It is frequently a mark of degeneration.

It is important that all such cases receive early treatment before the habit becomes firmly fixed. The prognosis is good for spontaneous recovery in nearly all the cases seen in very young children, and also in those coming on after acute illness. Other cases in which the condition has become habitual, should have the benefit of systematic training under a competent teacher in breathing, vocal, and speech gymnastics.

Stammering.—This term is sometimes used synonymously with stuttering. Kussmaul makes the distinction between them that, in stammering, individual sounds are difficult of production, while in stuttering it is syllabic combinations. Stammering is often accompanied by some defect in the organs of articulation—the teeth, lips, tongue, or palate—which is not present in stuttering.

The treatment consists in careful training and in the correction of whatever abnormal local conditions may exist.

Lisping.—In this there is imperfect production of certain sounds, owing usually to a faulty position of the organs of articulation. The sounds may be so indistinct that they can not be understood. In this condition also there may be defective formation of some of the organs of articulation, although in the milder forms this is not the case. The treatment is similar to that of stammering.

Alalia.—This consists in a
all young infants during their
children it is usually associated

Backwardness.—Backwardne
late development of speech due
deaf are almost invariably able
quence of prolonged or very seve
it may be lost from similar cause

Functional Aphasia.—The te
of speech which sometimes occu
fright or anything else which
pression. West records an inst
suffering from an attack of cho
came difficult and then was lost a
say only "Yes" and "No." The
of nine weeks had recovered com

Loss of speech sometimes fol
cially typhoid fever.

In all disorders of speech, the
from those which depend upon
frequency with which these disor
nutrition, and to local causes in
in mind, and these conditions sh
early, before the habit of defecti
For the latter class of unfortun
competent teacher should be advis

DISORDER

Disturbed Sleep, Sleeplessness.-
more common in infancy and chil
the causes of the two conditions m

Etiology.—In infancy these sy
hunger or to indigestion resulting
Very often disturbed sleep is the
during sleep or night-feeding. Sor
pain of colic or otitis; at other tim
condition of nervous irritability, th
surroundings.

In later childhood the first thir
disturbed is some derangement of
found the explanation of fully half

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* For the characteristics of the sleep
the different ages, see pages 5 and 6.

where the symptom is of long duration, is chronic intestinal indigestion, often associated with indicanuria, a condition in which the diagnosis of the mother is usually worms. Other cases are due to obstructed respiration from adenoid growths of the pharynx or enlarged tonsils, sometimes to nocturnal attacks of asthma. A lack of fresh air in the sleeping room, excessive or insufficient bedclothing, and cold feet, are other frequent causes. Disturbed sleep with "starting pains" is one of the earliest symptoms of hip-joint disease. In the nervous exhaustion resulting from overpressure in schools, and in malnutrition and anæmia, disturbances of sleep are well-nigh constant. They are also seen in organic cardiac disease and in all pulmonary conditions accompanied by dyspnœa or cough. Sleep may be disturbed in consequence of bad dreams which have their origin in exciting stories heard or read just before bedtime, or in too violent or exciting play. To discover the cause in almost any case it is necessary to investigate carefully the whole routine of the child's life.

Symptoms.—The condition may be one of real insomnia which may last for weeks or months; or the sleep may be simply disturbed and restless, the child waking many times during the night, and when asleep will not lie quietly, but constantly changes his position. Sometimes children wake suddenly with a scream, but immediately drop off to sleep again.

Treatment.—The essential treatment consists in the discovery and removal of the cause of the disturbance. This will often involve a radical change in the manner of feeding, in the hygiene of the nursery, and in all the surroundings of the child; but in this way only should these cases be managed. Under no circumstances should the physician countenance the use of drugs to promote sleep in children, except in the case of severe acute disease. Soothing syrups and all nostrums for "teething" should be absolutely forbidden. Mothers and nurses are only too ready to fall into the habit of using them, because the injurious effects are not appreciated. When the cause of sleeplessness is found and removed the child will sleep, but compulsory sleep obtained under other conditions is always productive of more harm than good. If food, diet, and all bad habits have been corrected, nervous causes must be investigated. When no cause can be discovered the treatment should consist in putting the child upon the simplest possible diet, and in attention to such general conditions as anæmia, malnutrition, and neurasthenia, some of which are almost certain to be present. In many cases a warm bath at bed-time will be found beneficial. A quiet, darkened room, plenty of fresh air, and the stopping of both eating and drinking during the night, are essential to a cure in most cases. When the condition accompanies some acute disease, the drugs which are most useful are codeia and trional. A child of two years may take $\frac{1}{25}$ of a grain of codeia or two grains of trional as an initial dose, to be increased if necessary.

Night Terrors—Pavor Nocturnus.—Two classes of cases have been grouped under this head, both having this in common, that sleep is disturbed by fright. In an excellent recent article upon this subject,* Coutts calls attention to the necessity of sharply distinguishing between them.

The condition in the first group partakes of the nature of nightmare. It may be due to partial asphyxia from adenoid growths of the pharynx, or to other causes mentioned under disturbed sleep, or it may be gastric or intestinal in its origin. These cases are quite frequent. Sleep may be disturbed from the outset, and the attack may be merely the culmination of such disturbance. The child wakes in a state of fright and excitement, and often says he has had a bad dream. His mind is clear, he recognises those about him, but it may be a long time before he is sufficiently calm to sleep again. The attack may be remembered perfectly the next day. Cases like this are to be managed in the same general way as cases of disturbed sleep above mentioned.

In the second group are the only cases to which the term "night terrors" should really be applied. These are relatively rare, but the condition is a much more serious one. The symptom is due to some disturbance of the central nervous system. According to Coutts, it occurs especially in those of neurotic antecedents, or those who have previously suffered from infantile convulsions, and it is often the precursor of other nervous attacks,—migraine, hysteria, epilepsy, and even insanity. The attack usually comes suddenly where a child has previously been sleeping quietly, and more frequently in the early part of the night than later. He is generally found sitting upright in his bed in a bewilderment of terror, being afraid of "the dog," or "the bear," or there is some other vision or hallucination which has produced the fright. Often this is associated with something of a red colour. The child does not recognise those about him, does not know where he is, and may go to sleep again without coming to full consciousness. The next day there is no recollection of what has happened. Usually no after-effects are seen, but sometimes a large amount of pale urine is passed. The attacks may be repeated at intervals of a few months, or they may occur every few nights; but whatever the peculiar nature of the vision, it is likely to be repeated in nearly the same form. Such attacks have something in common with epileptic seizures, and the diagnosis between them may at times be difficult. They are always to be regarded seriously, not only on account of what they are in themselves, but on account of what may follow.

Treatment.—All mental and nervous strain should be most carefully avoided, and where the attacks are frequent the bromides should be given at bedtime. Some person should sleep in the same room with the child, or in an adjoining one with the door open.

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* American Journal of the Medical Sciences, February, 1896.

Excessive Sleep.—It is rare that either infants or children sleep an unnatural amount of the time unless one of two causes is present—organic brain disease or the use of drugs. The latter is always to be suspected if with the sleep there is associated obstinate constipation. Opium in the form of "soothing syrup" or paregoric, is the drug which has usually been given.

INJURIOUS HABITS OF INFANCY AND CHILDHOOD.

On account of the close connection of these habits with disturbances of the nervous system, they may be properly considered with the functional nervous diseases. Although some of these habits may not be of serious importance, yet as a group they have received altogether too little attention at the hands of the physician.

Sucking.—This is a very common habit in infants, and during the first few months it is seen to some degree in most of them. If they are carefully watched the habit is easily stopped; otherwise it may continue indefinitely. Young infants usually suck the fingers when hungry, and this can scarcely be considered abnormal, but an effort should always be made to stop it, lest the habit become fixed. Lindner * distinguishes between simple sucking and sucking with combinations. In the former, the child sucks some part of the body, such as the thumb, fingers, toes, tongue, lips, back of the hand or arm, or it may be some foreign substance, such as part of the clothing, the blanket, a rubber nipple, or a "sugar-teat." This is the most common form that is seen. In the second variety the sucking is accompanied by the rubbing of some other parts, which seems to afford a pleasurable excitement; this may be the ear, the genitals, or any other portion of the body. Sometimes sucking is accompanied by some practice which produces actual pain, such as pulling of the hair or scratching the body. Habits of sucking often persist throughout infancy, and not infrequently throughout childhood; they have often been known to continue up to puberty. The longer the habit has lasted the more difficult is it to break.

The results of sucking may be serious. Deformities of the thumb or finger, of the lips and teeth, and even of the jaws, are sometimes produced. I know a lady, now in advanced life, whose thumbs to this day show a deformity resulting from the habit of thumb-sucking while a child. In her case the habit was not broken until she was eight or nine years old. Probably the most pernicious result of sucking is its tendency to develop the habit of masturbation. Habitual sucking of one hand or finger may lead to spinal curvature.

Treatment.—In the management of these cases the most important thing is to arrest the habit early, before it becomes fixed. Too often the

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* Jahrbuch für Kinderheilkunde, vol. xiv, p. 68.

habit of thumb-sucking, or of
mothers and nurses, because
produced; even physicians ar
Under no circumstances shoul
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and parents should be put o
treatment which is at all succe
make sucking an impossibility.
is sucked with bitter solutions.
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of young infants may be covered
a night-gown which is pinned to
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must be carefully watched at a
sleep and when they first wake,
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discontinued spontaneously when
old; but when it has been indul
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Punishments are of little avail,
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Masturbation.—This is not u
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two years old, some of them most
frequent after the eighth or nint
fifteenth that it is especially see
seen in males than in females, alt
control.

The symptoms which these o
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are pale and anæmic; they have
poorly, are easily fatigued, and fre
become quiet, reticent, and easily
other children, and lose all anin
amusements. They are absent-mi
trate the attention upon anything.
more morbid, and in extreme cases
ness, or even insanity. In other c
may follow. I had recently unde

was having from six to ten epileptic seizures a week, in whose case masturbation appeared to be the principal cause. I do not, however, think such cases are frequent. Sometimes hysteria and chorea are traceable to the influence of masturbation, this result being, of course, more likely to follow where there already exists a predisposition to these diseases. In addition to these effects upon the nervous system, where it is begun at an early age, masturbation may seriously interfere with the physical development of the child. The local symptoms of masturbation in the male, are redness and sometimes slight swelling of the prepuce; but very often there is simply a relaxed condition of all the genital organs. In the female there may be redness and swelling of the vulva, and in some cases a moderate vaginitis.

Among the local causes may be mentioned anything which excites undue irritation,—a long or adherent prepuce, phimosis, balanitis, vaginitis, any skin disease which causes itching of the part, thread-worms, and even constipation. Urine which is rendered irritating on account of excessive acidity or the presence of crystals of uric acid, is a not infrequent cause. Exercises in which the legs are rubbed together may lead to it, also posture or clothing which causes friction of the parts, and sometimes warm feather-beds. To these must be added as a potent cause, the habit of sucking. Masturbation often results from example or because the habit has been taught by other children, sometimes by nurses. Where it develops in a young child without local cause, it should not be forgotten that masturbation is one of the signs of degeneration, often an early one, and other stigmata (page 758) will usually be found if they are looked for.

In infants and very young children masturbation is often not recognised. At this age it is more frequently accomplished by thigh-friction, or by rubbing the genitals against a chair or some other object, than by the use of the hands. The variety of ways is almost endless. During the act there are usually noticed flushing of the face and some rigidity of the muscles of the trunk and lower extremities, which are followed by complete relaxation and often by perspiration.

The prognosis depends most of all upon how firmly rooted the habit has become before it is recognised. It is usually a simpler matter to stop it in infants and in young children, as they can be more easily controlled and more closely watched than those who are older. The outlook is much better where the cause is a local one capable of being removed, than where no such cause exists. It is also much better when in an older child it has been acquired by imitation, than where it is a symptom of degeneracy; in fact, the last-mentioned cases are rarely if ever cured.

Treatment.—The most important thing is an early recognition of the condition. The physician should put parents and nurses on their guard, and the first suspicions should be reported and the child carefully watched until all doubt is removed. In most cases seen by the physician the habit is not difficult to arrest after it has been practised fo infants much may be accomp of restraint which is necessary bating. If by the hands, the child can not reach the genit be separated by tying one to e a double side-splint, such as is plied. In children that are ov almost invariably unsuccessful. case to have the child under trustworthy person. He should to bed and immediately after w ful in very young children, but four years old. In fact, in such and lying are soon added to the the child's confidence, and in e will and stimulate his self-cont the habit. The local causes, t whenever found. Circumcision even where it is not, the moral very great benefit. Care shou irritate the parts. The child sh panions. In some cases hypnot sults. The general treatment sh Cold bathing should be practised are indicated by the general con as healthful local surroundings a for the habit itself is of little or

Nail-biting and Tongue-sucki frequent and less important than is best remedied by keeping the becomes a fixed habit, and the ch he grows older.

CHAPTER III.

DISEASES OF THE BRAIN AND MENINGES.

MALFORMATIONS.

THE malformations of the brain are of great variety, and many of them are solely of anatomical interest, as the conditions are incompatible with life. Only the most frequent and the best-known types will be mentioned, and those which are of interest from a clinical point of view.*

Meningocele, Encephalocele, and Hydrencephalocele.—These three conditions have in common a protrusion of some part of the cranial contents through an opening in the skull. In meningocele (Fig. 110) there is protrusion of the membranes alone. These form a sac, which is usually, but not invariably, distended by fluid. In encephalocele (Fig. 111) there is a protrusion of a portion of the brain substance; this is connected with the rest of the brain by a constricted neck or pedicle. There may or may not be fluid present in the tumour. In hydrencephalocele (Fig. 112) there is a protrusion of a portion of the brain substance which contains within it a cavity filled with fluid, this cavity communicating with the distended lateral ventricles.

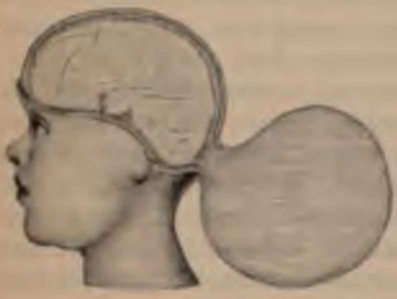
FIG. 110.—Meningocele.

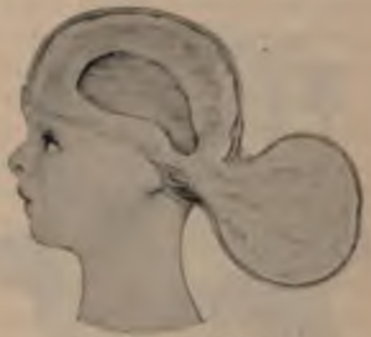
FIG. 111.—Encephalocele.

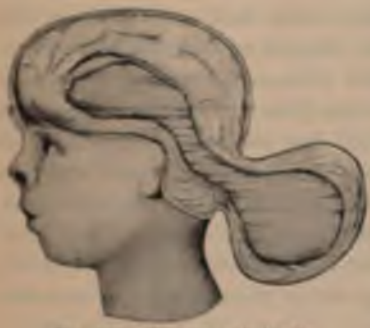
FIG. 112.—Hydrencephalocele.

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* For other forms see Sachs, Nervous Diseases of Children, 1895, pp. 589–607.

In all these conditions there is a tumour, usually pedunculated, of a round or pyriform shape, with a smooth or lobulated surface. The ordinary size is that of a mandarin orange; it may be as small as a walnut, or as large as the patient's head. It is generally covered by the scalp, which is often denuded of hair; but it may be covered only by granulation-tissue, or it may show a central cicatrix, like that of spina bifida. Its coverings are usually thin and translucent. Other deformities, such as spina bifida, club-foot, and hare-lip, are frequently present.

All these conditions are rare, but the most frequent and most serious one is hydrencephalocele, this being usually associated with hydrocephalus. The next in frequency is encephalocele, which has the best prognosis. This is frequently termed *hernia cerebri*. It may exist without very serious alteration in the cranial contents. If fluid is present, it is external to the brain. Meningocele is the rarest form, and consists simply of an accumulation of fluid in the arachnoid cavity, which communicates by a small opening with the general arachnoid cavity of the brain.

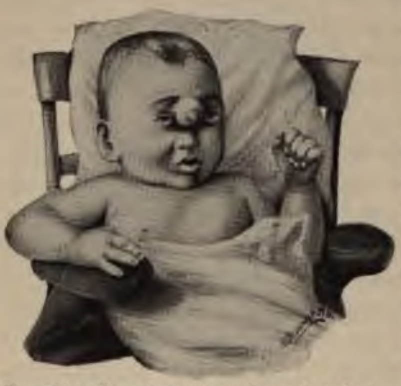
FIG. 113.—Naso-frontal meningocele (after Demme).

Of one hundred and five cases collected by Schatz, fifty-nine occupied the occipital region and forty-six were frontal. The aperture through which the occipital protrusion takes place is usually in the median line. It may communicate with the posterior fontanel, with the foramen magnum, or with the cleft of a spina bifida. The occipital bone may be divided in the median line, or rarely it may be absent.

In the naso-frontal form (Fig. 113) the tumour is usually at the root of the nose, a little to one side of the median line. The aperture is most frequently between the cribriform plate of the ethmoid and the frontal bones. It may be between the lateral halves of the frontal bone, causing a median tumour. The point of protrusion may also be the lateral region of the skull, generally about the lateral fontanel, or along the line of the sutures; it may project into the mouth or the pharynx. These anterior tumours are usually small, although large ones containing the anterior lobes of the brain, have been seen.

The theory of the origin of these malformations which is most widely accepted is that they are primarily cases of intra-uterine hydrocephalus, and as the cranial cavity has gradually been closed by the development of the bones, a certain portion of the brain has been left outside.

Symptoms.—The tumour is always congenital, although after birth it frequently increases very much in size. A typical tumour is round and elastic, usually giving evidences of fluid; it pulsates synchronously with the heart; during screaming or forced inspiration, it increases in size; partial and in some cases complete reduction is possible, but this is usually followed by marked cerebral symptoms, even by convulsions. After partial reduction, an opening in the skull may often be made out. Microcephalus may be present, or there may be unequal development of the two sides of the head.

The following differential points given by Treves, indicate the most characteristic features of the three varieties: In meningocele, the tumour is at first small, but increases; it has a smooth surface; it is pedunculated; there is distinct fluctuation, perfect translucency, rarely pulsation; often it is completely reducible; compression of the tumour causes cerebral symptoms; the skull is normal. In encephalocele, the tumour is small and smooth; it is rarely pedunculated; fluctuation is absent; it is not translucent; there is distinct pulsation; it is usually reducible; pressure causes cerebral symptoms; the skull is normal. In hydrencephalocele, there is a large pendulous tumour with an irregular or lobulated surface; it is pedunculated; translucency is rarely complete; fluctuation is distinct; it is irreducible; pressure rarely causes symptoms; microcephalus and other deformities are often associated.

The occipital tumours are usually more serious than the frontal ones. The majority of cases die in the course of the first few weeks of life, death resulting from meningitis, convulsions, or rupture. In meningocele the tumour usually grows slowly, and ultimately may be shut off from the cranial cavity; but gradual thinning of the membrane may take place, and spontaneous or accidental rupture occur. In encephalocele the tumour grows slightly, or not at all. Most of these patients exhibit signs of mental impairment or other evidences of organic brain disease.

Treatment.—According to Treves, operation is justifiable only in case of impending rupture. The conditions present are essentially the same as in spina bifida. Meningocele may be aspirated, injected with iodine, or with Morton's iodine and glycerin solution (page 765); the sac may be laid open and a plastic operation performed for the closure of the communication with the cranial cavity; or the skin may be divided, and a ligature or clamp applied to shut off the communication with the brain. All these methods have been at times successful, but cure has in many instances been followed by the development of chronic hydrocephalus. Encephalocele is to be treated by protection and compression. Aspiration may be resorted to if fluid is present. In hydrencephalocele the prognosis is absolutely bad under all circumstances. Schatz[*] gives the following statistics, showing the results with and without operation, all varieties being included: Of twenty-four occipital tumours not operated on, three

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[*] Berlin. klin. Wochenschrift, No. 28, 1885.

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six recovered. Of forty-six fr
thirty-two cases without opera
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Microcephalus.—This is ge
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Congenital Hydrocephalus.—T
belonging to this category, althoug

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* New York Medic

Porencephalus (literally, a hole in the brain) is a condition in which there is a large depression in some part of the brain, but with surrounding parts well developed. Such depressions may involve a whole lobe, and they may be deep enough to reach the lateral ventricles.

Porencephalus is described as congenital or acquired. In the congenital form, the defect is usually found in the anterior or middle part of the brain. The origin of these conditions is still a disputed question. They are probably due to early vascular changes. Children sometimes live several years with very large defects, the symptoms depending upon the seat of the lesion. The acquired form of porencephalus is usually one of the late results of meningeal hæmorrhage. It may affect one or both sides. Such cases present the symptoms of spastic paralysis—usually diplegia. In all cases with large brain defects, the space is filled with fluid.

PACHYMENINGITIS.

Pachymeningitis, or inflammation of the dura mater, occurs both as an acute and a chronic disease.

Acute Pachymeningitis.—This is very rare in children. Only pachymeningitis externa is generally included under this term, as acute pachymeningitis interna does not occur alone, but usually with inflammation of the pia mater (leptomeningitis). It may be associated with disease or injury of the bones of the skull, but is most frequently seen in connection with middle-ear disease. It generally begins as a localized process, but the inflammation may extend to the inner layer, and to the pia mater; or it may remain circumscribed, and terminate in the formation of an abscess between the dura mater and the bone.

The symptoms of acute pachymeningitis are distinctive only when the process is localized. They are then usually associated with middle-ear disease, and are indistinguishable from those of cerebral abscess. The treatment is surgical.

Chronic Pachymeningitis.—This, in children, almost invariably affects the inner layer (pachymeningitis interna); it is also known as *pseudomembranous* and as *hæmorrhagic pachymeningitis* or *hæmatoma of the dura mater.* Its causes are for the most part unknown. It is not very rare, being usually discovered at autopsy in children, chiefly cachectic infants, who have died of other diseases. In the Report of the New York Pathological Society for 1890 Northrup records six such cases. I have seen five similar ones, as well as one other associated with chronic hydrocephalus.

Two classes of cases are to be distinguished,—those with, and those without extensive hæmorrhages. In the latter group there is found a thin, translucent, vascular membrane lining the inner surface of the dura. It may be only a delicate film which can be scraped off; it may be as thick as ordinary blotting-paper, or even twice that thickness. The membrane

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Symptoms.—These are due t
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rhage. The respiration is slow and irregular and may be of the Cheyne-Stokes variety. The pulse is slow, irregular, and sometimes intermittent. The temperature is at first normal, but rises slowly until death occurs, when it is from 100° to 103° F. Generally the cranial nerves are not affected, and opisthotonus is absent. The knee-jerk is often exaggerated. In cases which do not prove fatal—these being chiefly in older children—we have a similar onset, but after a few days consciousness is regained, and only hemiplegia or monoplegia remains. The course of the paralysis is that seen after meningeal hæmorrhage due to other causes. Wagner has reported a case in which recurring hæmorrhages took place at intervals of several months, the autopsy showing distinct evidences of both old and recent lesions.

Pachymeningitis, I believe, plays a much more important rôle in the production of meningeal hæmorrhages in children than has generally been accorded to it. From the frequency with which this lesion is found as a cause of sudden meningeal hæmorrhages which are fatal, it is not unlikely that many of the cases which recover with hemiplegia or monoplegia, may be due to the same cause.

The prognosis depends upon the age of the patient and the extent of the hæmorrhage. Extensive hæmorrhages are usually fatal in infancy, but small ones are seldom so, for they are rarely at the base. The prognosis of the paralysis in cases not terminating fatally, is the same as after meningeal hæmorrhage due to other causes, with perhaps an added liability to recurrent attacks.

Without large hæmorrhages, pachymeningitis interna can not be diagnosticated; and it is impossible to differentiate the hæmorrhagic cases from other varieties of meningeal hæmorrhage. It is important to make a diagnosis between pachymeningitis with hæmorrhage, and acute simple meningitis. In the former we have a sudden onset; stupor occurring early, usually on the first day, gradually diminishing in cases of recovery, or deepening into coma in fatal cases; localized or general paralysis, also occurring early; there is no fever in the beginning, and only moderate fever at the close. In acute meningitis we usually have a higher temperature, especially early in the disease; coma develops later, and rigidity of the extremities is less pronounced. In certain cases, however, where the hæmorrhage occurs in the course of some other disease, a differential diagnosis may be impossible.

Treatment.—The treatment of pachymeningitis hæmorrhagica is symptomatic. The indications are, to relieve cerebral congestion by applying ice to the head, to allay irritative symptoms by the use of bromides, and to keep the patient perfectly quiet.

ACU

Acute inflammation of the
under a variety of circumstanc

1. It occurs epidemically.
process in the cord, and is kn
fever, being regarded by many
lesion.

2. It occurs sporadically a
lesions which may be identica
cases.

3. It occurs as a secondary
diseases and local inflammation

At the present time we are
groups by the clinical symptom
bacteriological study of the mi
process. All the forms will the
eral head.

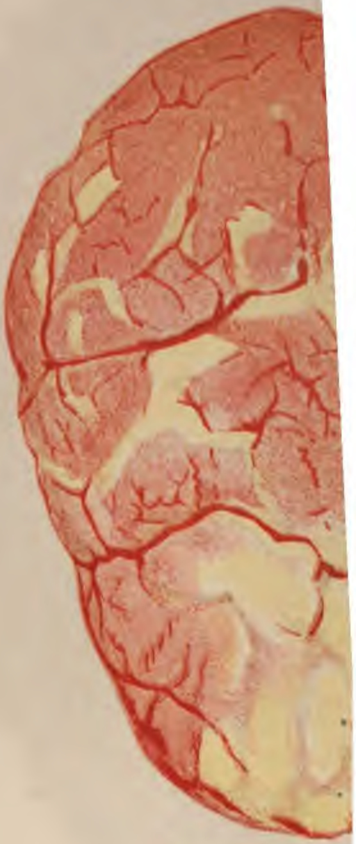
Etiology.—Epidemic meni
spring; it affects children of
males. It is attributed to overc
apartments, and, in some epide
soning. It is not contagious, in
demics are usually separated by
occur the number of persons
cases are seen every year; but in
and the disease is then said to b

Sporadic cases of meningiti
stroke, or they may occur with
prevailed epidemically, or even w
great majority of cases no adequ

Acute meningitis occurs as a
nia, scarlet fever, variola, influen
simple meningitis as a complic
infrequently complicates acute n
scarlet fever. It may be second
or abscess of the brain.

The bacteriological findings
thus far have not been uniform
found has been the pneumococ
cent writers are inclined to regar
demic meningitis. The pneumo
even in pure culture, as in one
teen months; but, on the other

PLATE XV.



Acute Meningitis, com

Child twenty months old; on twenty-
vomited six times, and the temperature,
rose to 103° F. On the following day g
quently during the next few days; temp
on twenty-eighth day.

Autopsy.—Pleuro-pneumonia of left
brain enveloped in lymph and pus, mo
over the base.

1894, when the disease was regarded as epidemic in New York, Biggs found that in cases observed in one hospital (Bellevue) with similar symptoms and with the same gross lesions, there was no uniformity in the bacteriological findings. The pneumococcus was present in some, in others the streptococcus or staphylococcus, each form usually existing in pure culture in the case in which it was found.

While the pneumococcus is undoubtedly the micro-organism most frequently concerned in epidemic meningitis, it is certainly not the only one. In sporadic cases also it plays the most important part. Of twenty-five such cases studied by Netter, the pneumococcus was found in eighteen, the streptococcus pyogenes and staphylococcus pyogenes albus in four, and various other bacteria in the remainder. In the secondary cases, the pneumococcus is usually found when meningitis complicates pneumonia or influenza. Under other circumstances, any of the varieties of pyogenic bacteria may be met with.

Lesions.—In the most severe cases, and especially when the disease is prevailing epidemically, death may take place so early that the changes found at autopsy are slight. There may be only a serous exudation and intense hyperæmia, this being much less marked after death than during life. The microscope, however, may show, even in these early cases, an abundant exudation of leucocytes in the pia mater. In other cases, especially in infants, we may find an extensive purulent exudation where the symptoms have apparently lasted only twenty-four hours. In cases of three or four days' duration the lesions are quite uniform. The convolutions appear somewhat flattened from pressure due to distention of the ventricles. The inner surface of the dura is usually normal or only congested. There may be thrombi in any of the cerebral sinuses, or in the meningeal veins of the convexity. The brain is enveloped in an exudation of greenish-yellow lymph, which is usually abundant, and may nearly conceal the convolutions (Plate XV). It is generally most marked over the anterior half of the brain, and at the base, occurring elsewhere in patches. Exceptionally it may be found only at the base or at the convexity, but usually it is very extensive. There is an increase in the quantity of cerebro-spinal fluid. The ventricles are moderately distended with serum or sero-pus, and their walls may be slightly softened. To the naked eye the brain substance may show no changes except some congestion of the superficial layers of the cortex. In the meninges of the cord lesions similar to those of the brain are usually seen. The exudation is principally upon the posterior surface, and may extend throughout the entire length of the cord, or be limited to its upper or to its lower portion. In some cases the cord lesion is overlooked, because the whole cord is not examined.

Microscopical examination shows the exudation to consist of fibrin and pus cells, which infiltrate the pia mater and may cover its surface.

The superficial layers of the cortex in the inflamed areas sometimes show minute hæmorrhages and very marked cell-infiltration. Extension from the meninges to the substance of the cord is less common. Inflammatory products may be found in the central canal of the cord, and occasionally in the walls of the lateral ventricles of the brain. The lesions most frequently found in other organs, are acute parenchymatous degeneration of the liver, spleen, and kidneys, pneumonia, pleurisy, and peritonitis.

In sporadic cases of meningitis the lesions are identical with those above described. In the secondary cases, as a rule, the cord escapes, although the lesions in the brain are usually the same as when the disease is primary. When meningitis occurs as an extension from otitis, it begins in most cases as a localized process, and afterward becomes general. It is usually complicated by septic thrombosis of the lateral sinuses.

In the cases of meningitis which recover, there is an absorption of the greater part of the inflammatory products; but the pia mater may be thickened and adherent to the brain; areas of sclerosis may develop in the cortex, and chronic hydrocephalus may follow. I have three times had the opportunity of making autopsies upon cases which died at periods varying from four months to a year after the original attack of meningitis. There were found in all of them, thickening and cloudiness of the pia mater, usually most marked at the base. No remains of the exudation were seen except small deposits of fat occurring in irregular patches at the base and the convexity, not unlike miliary tubercles. This was seen in regions where the lesions had been most intense. In one case dying six months after the acute attack, the pia was adherent over the entire cortex of the brain;* the microscopical examination showed a thickening of the pia mater with an exudation of cells between the pia mater and the brain, and in places a commencing secondary encephalitis. A continuance of such a process as this may give rise to a localized or a diffuse sclerosis which may impair the functions and growth of the brain. Such lesions are most frequently seen over the frontal and temporo-sphenoidal lobes.

Symptoms.—Few diseases are so irregular in their course or present so many atypical forms, as does acute meningitis.

1. *The common form.*—Most of the sporadic and epidemic cases are of this type. The acute symptoms are sometimes preceded by a prodro-

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* The clinical features of this case were also interesting. The patient was a bright little girl of four and a half years, who had in May a typical attack of meningitis of moderate severity. She made a very slow convalescence, but at the end of two months recovery was perfect in everything but her mental condition. She remembered nothing which she had previously learned in the kindergarten, where she had been an exceptionally bright pupil. Her mind was a blank. She was dull, listless, and her face had a vacant, idiotic expression. The special senses seemed unaffected, and speech was retained. She died during an attack of convulsions in November.

inal stage of one or two days, characterized by general weakness and indefinite *malaise*, but in the majority this is wanting, and the attack begins suddenly with vomiting or convulsions, headache, and high fever. The initial temperature is from 102° to 105° F. There are present intense headache, marked prostration, pain in the back of the neck and along the spine, general hyperæsthesia, opisthotonus, constipation, retraction of the neck, and rigidity of the cervical muscles. Later, more intense nervous symptoms develop. There is delirium, which is often active, to which are added muscular twitchings, and sometimes convulsions; or there may be dulness, apathy, and finally complete coma. The respiration is slow, sometimes irregular. The temperature is elevated, usually between 101° and 104° F. There are seen in a few of the cases fine petechial spots upon the face, abdomen, or all over the body. The pupils are irregular; there may be strabismus or nystagmus. The pulse is weak, and sometimes slow, sometimes rapid.

After these symptoms have lasted from two to ten days, the patient may become completely comatose, with general relaxation and dilated pupils, and may die in this condition or in convulsions. In other cases he passes into a typhoid condition, and death occurs from exhaustion or complications, particularly pneumonia. The usual duration of these attacks is from one to two weeks. If the case recovers there is a gradual subsidence of the nervous symptoms and sometimes quite a rapid convalescence; or the disease may pass into a subacute form, lasting from three weeks to two or three months, improvement being slow and interrupted by relapses. Severe cases may be followed by deafness, localized paralysis, or an impaired mental condition.

2. *Abortive cases.*—In every epidemic there are seen attacks which begin precisely like those above described, but where the symptoms last only two or three days and then subside rapidly, the case going on to a complete and permanent recovery. In some epidemics the number of such cases is quite large.

3. *Malignant or fulminating cases.*—These also occur principally in epidemics, but are not confined to them. The onset in this type is very abrupt, and the patient may be overcome by the poison and die in from twelve to thirty-six hours. These cases often begin with convulsions and very high temperature, from 104° to 106·5° F. There is very great prostration and frequently cyanosis. There may be opisthotonus and general hyperæsthesia, or these may be absent. The patient may pass in a few hours into a condition of collapse, with general relaxation, feeble, irregular pulse, and cold extremities, followed by convulsions and death. If life is prolonged, there may follow after a few hours a period of reaction, in which irritative symptoms are prominent,—headache, photophobia, contracted pupils, general hyperæsthesia, and active delirium. The eruption may appear within the first twenty-four hours after the onset.

In most of these cases a positive diagnosis is impossible, as the general toxic symptoms mask the local evidences of cerebral inflammation. The diagnosis is not likely to be made except when the disease is prevailing epidemically.

4. *Acute primary meningitis occurring sporadically* does not differ in any essential particulars from the epidemic form. The fulminating and the abortive cases are, however, less frequent than when the disease is epidemic.

5. *Acute secondary meningitis* presents quite a different clinical picture, and the symptoms are greatly modified by those of the original disease. In general, its course is shorter, and it is more uniformly fatal than is primary meningitis. The diagnosis is difficult, and in many cases the lesions are found at autopsy where no marked cerebral symptoms have existed during life. This is particularly true where the process is mainly at the convexity. The onset is generally with convulsions, after which there may develop quite rapidly stupor and finally coma, with dilated pupils, slow pulse, and irregular respiration. Convulsions and gradually deepening stupor may be the only symptoms; or there may be opisthotonus, retracted abdomen, and rigidity of the extremities. The duration of these cases is quite short, being rarely more than three or four days, and often but one or two. Death usually occurs in convulsions.

The nervous symptoms.—Headache is a frequent symptom of meningitis and is often severe; it is more likely to be frontal than elsewhere, although it may be general and associated with vertigo. There may also be pains in the back of the neck, along the spine, or in the muscles, which may be so intense as to cause the patient to scream out. Pain may be present only in the early stage, or continue throughout the disease. With this there may be tenderness along the spine, and often general hyperæsthesia, which may be so acute that any movement causes agonizing cries. Delirium is frequent in the severe cases after the first day; it may be wild and active, or low and muttering. After delirium there follows usually a stage of apathy which may develop into complete coma; deep coma, however, is not often present in cases that recover. Convulsions mark both the onset and the close of the disease, but rarely occur during its progress. Tonic spasm of the various muscles gives rise to deformities which may continue through the attack. The rigidity and contraction of the muscles of the neck produces cervical or general opisthotonus; there may be tonic flexion or extension of the extremities, especially of the legs. In some epidemics opisthotonus is seen in nearly every case, in others it is infrequent. In most of the protracted cases localized paralysis is present in the course of the disease. It may affect one side of the body, or one extremity.

Special senses.—The eyes are affected in almost all severe attacks. The pupils in the early stage are generally contracted, later they may be irregular, and toward the close they are usually widely dilated. External strabismus is by far the most frequent form of ocular paralysis. The fundus is rarely normal. In a study of thirty-five cases, Randolph (Baltimore) noted the following changes: The fundus was the seat of venous engorgement and tortuosity, with more or less congestion of the optic disc in nineteen cases; there was optic neuritis in six cases; retinitis with thrombosis of the central vein in one case. Of the seven cases in which the fundus was normal, one had strabismus, one nystagmus, and one greatly dilated pupils. Inflammation of the conjunctiva is also very frequent. Deafness is common during the acute stage of the disease, and is its most frequent sequel. It may be due to the cerebral lesion, to otitis media, or to otitis interna. The last mentioned may result from an extension of inflammation along the course of the auditory nerve.

Speech is disturbed in most of the protracted cases. Bulging of the fontanel is one of the regular symptoms in young infants. Marked prostration is always present; it may come very abruptly, and may be followed by collapse, or may last but a short time and be followed by a period of reaction.

The *temperature* is always elevated, being especially high at the onset. In the fulminating cases there may be hyperpyrexia,—105° or even 106° F. The usual range is between 100° and 104° F. In cases terminating in recovery, the fever usually lasts from one to two weeks and gradually falls to normal. There is no regular or typical curve. The height of the temperature may bear no relation to the severity of the other symptoms. It may be low throughout, even in the fatal cases. A subnormal temperature is also a bad sign.

The *respiration* is slow and irregular as the disease progresses, and it may be of the typical Cheyne-Stokes variety. Cyanosis is often present in cases where no cause for it can be found in the heart or lungs; it is especially frequent in the fulminating cases. Pneumonia is one of the most common complications.

The *pulse* in the early stages is full and rapid; later it becomes slow, irregular, and feeble, and may be intermittent.

The examinations of the *blood* made by Barker and Flexner (Baltimore) showed the presence of marked leucocytosis in every fatal case examined. Epistaxis is not uncommon as an early, and sometimes as a late, symptom.

Digestive system.—Vomiting is frequent at the onset and may be persistent. The bowels as a rule are constipated, although there may be diarrhœa, and as a complication even dysentery has been observed. The tongue is often coated; sometimes it is dry and glazed, or covered with sordes. Deglutition is sometimes difficult on account of the retraction of the neck. The spleen is usually not enlarged. Jaundice occurs in a small proportion of the cases.

Eruptions.—In the majority of cases, the skin presents no changes

In others there is herpes of the
face or body consisting of fine
travasations. These are partic
or the ears, and from this symp
In some cases a general erythem
be seen during the early part of
hours. Late in the protracted
rhages over the abdomen, as in

The large joints, particularly
painful, the symptoms resembli
nence of urine and fæces may oc
ciated with low delirium and oth
is not infrequent, and often over

Course, Termination, and Pro
the fatal cases is usually less t
occur within forty-eight hours.
Of the cases which terminate in
the majority last at least two week
After three or four weeks, there i
the fever and of most of the acut
mains emaciated, very weak, with
pains or hyperæsthesia, and ofte
may slowly disappear, or it may
perfectly so far as all the physical
deficient.

The sequelæ of meningitis rela
may be hemiplegia or monoplegi
be temporary or permanent. Of
to be affected, deafness being quite
mutism not an infrequent result
and may be due to optic-nerve a
Speech is sometimes affected; an
seen after an attack. As a late re

Meningitis is usually more fat
sporadic cases. The mortality in
seventy-five per cent. The younge
and in infants the disease is usuall

Diagnosis.—The diagnosis of a
culties in young children, because
symptoms are seen in all forms of
in their course. In infants the u
meningitis where there is none,
present. The symptoms most to
tinued stupor or coma, opisthoton

—especially if associated with high fever—localized paralysis, rigidity of the extremities, and a retracted abdomen. Cases where the principal lesion is at the convexity are particularly obscure, and the diagnosis often is not made during life. There is no opisthotonus or cranial-nerve symptoms, and irregularity of pulse and respiration are rare.

At the onset, meningitis is most likely to be confounded with pneumonia, scarlet fever, and influenza. Pneumonia is recognised by the accelerated respiration and the physical signs; scarlet fever, by the congestion of the throat and the eruption; from influenza the diagnosis may be almost impossible except from the course of the disease. From all other diseases, meningitis is differentiated by the continuance and the severity of the nervous symptoms, rather than by the presence or absence of single or special symptoms.

Quincke's procedure of lumbar puncture of the spinal canal * furnishes a means of differential diagnosis of considerable value. It is especially useful in distinguishing meningitis from other diseases accompanied by marked cerebral symptoms. In meningitis there is invariably found, according to Wentworth (Boston), a distinct cloudiness of the cerebrospinal fluid. In some cases this is very marked, in others it is so slight as to require careful comparison with distilled water in a test-tube, to make it apparent. In addition there may be found during inflammation an excess of albumin, a deposit of leucocytes, and any of the various bacteria which produce meningitis.

A differential diagnosis between epidemic meningitis and the sporadic form is impossible. The diagnosis of simple from tuberculous meningitis is easy in typical cases, but in certain forms of the disease it is extremely difficult and sometimes impossible. The most striking points of contrast are, that in simple meningitis the onset is usually abrupt; the temperature is high; the disease develops rapidly; and in forty-eight hours—sometimes in twenty-four—nearly all the severe nervous symptoms may be present; pain in the spine and general hyperæsthesia are quite frequent. Usually the patient is a child who has been in perfect health up to the beginning of the disease; or there is present some local cause, such as middle-ear disease, or traumatism; or an epidemic may be prevailing. In tuberculous meningitis, the onset is usually insidious; the temperature low; the pros-

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* Puncture is usually made between the third and fourth lumbar vertebræ a little to one side of the median line. The smallest exploring needle may be used, and for convenience it may be attached to a syringe as a handle, as it is not necessary to aspirate. The canal is reached at a variable depth, usually about one inch from the skin. The body should be flexed during the operation so as to separate the vertebræ, and unless the patient is comatose an anæsthetic is advisable. All observers agree that with a clean needle lumbar puncture is harmless. See Jacoby, New York Medical Journal, December 28, 1895, and January 4, 1896; Caillé, New York Medical Journal, June 15, 1895; and Wentworth, Transactions of the American Pædiatric Society, 1896.

tration not marked for the first few days; the evolution of the nervous symptoms is often slow and irregular, and the child may be sick a week before he appears to be seriously ill; pain in the spine and general hyperæsthesia are rare. The child is usually one who has a history of hereditary tuberculosis; or who has been previously delicate, or who has suffered already from some other form of tuberculosis, in the lungs, bones, or lymph nodes. In cases of sporadic meningitis which are apparently primary, the tuberculous is much more frequent than the simple form,—in my experience fully three to one.

Treatment.—The treatment of acute meningitis is quite unsatisfactory, and it is very doubtful whether the result is greatly modified by any special plan of treatment; it seems to depend upon the age of the patient, and the nature and severity of the attack, rather than upon its management. The treatment directed toward the inflammation consists in the constant use of an ice-cap to the head, and at times an ice-bag along the spine. Counter-irritation may be maintained by painting the nape of the neck and the spine daily with a strong tincture of iodine, or by blisters, but best of all by the Paquelin cautery. The bowels should be kept freely open by calomel or saline cathartics. Internally, ergot and iodide of potassium should be given in as full doses as will be tolerated by the stomach.

Of the symptoms which call for special treatment, the most prominent one is pain, which when severe requires morphine, often in large doses. It is often best to give it hypodermically. For other nervous symptoms—delirium, sleeplessness, etc.—the bromides and chloral, sulfonal, or trional may be given, or warm sponge baths. Stimulants are required in most of the cases at some time in the course of the disease. They are indicated by weak, rapid, and irregular pulse. Alcohol and digitalis should be used, but not strychnine. The difficulties in feeding these patients are sometimes great, but they can often be overcome by the use of gavage (page 62), which may be advantageously employed as a routine practice in the most severe cases. The physician should be on the watch for bedsores, and endeavour to prevent them by cleanliness, frequently changing the patient's position, etc. The bladder also must not be forgotten, as retention of urine is not uncommon, and may require the use of the catheter.

For the residual paralysis, massage, warm baths, and friction should be employed, but electricity only when all symptoms of central irritation have subsided. The prolonged use of iodide of potassium seems to have considerable influence in promoting absorption of the inflammatory products in cases where there is a persistence of symptoms for two or three months.

TUBERCULOUS MENINGITIS.

Synonyms: Acute hydrocephalus; basilar meningitis; water on the brain.

Tuberculous meningitis is a tuberculous inflammation of the pia mater of the brain, sometimes involving also that of the cord. It is doubtful if it ever occurs as the only tuberculous lesion of the body. It is quite frequently seen, and is more uniformly fatal than any other disease of early life. In infancy it is usually associated with general or pulmonary tuberculosis; in older children with tuberculosis of the bones, joints, or lymph nodes. Of my own cases, twenty-five per cent of all deaths from tuberculosis in children, were due to meningitis.

Lesions.—The lesion consists in the production of miliary tubercles, with which are frequently found tuberculous nodules of variable size, and in almost every case there are also the products of ordinary inflammation of the pia mater—lymph and pus—together with an accumulation of fluid in the lateral ventricles of the brain. Frequently there are tubercles in the pia mater of the upper portion of the cord. The miliary tubercles appear as small gray or white granules, situated along the vessels of the pia mater. When few in number they are usually only at the base, especially along the Sylvian fissures and in the interpeduncular space. When numerous they are most abundant at the base, but are also seen scattered over the convexity in small groups. In about half of my autopsies they have been limited to the base, and in no case were they seen exclusively at the convexity. Tubercles are often found in the choroid coat of the eye. The amount of lymph and pus present is rarely great, and never equal to that seen in simple acute meningitis. It is often a matter of surprise at autopsy to find the lesions so few, after very marked symptoms. The inflammatory products are most abundant at the base. In addition to the patches of greenish-yellow lymph, there are adhesions between the lobes of the brain and thickening of the pia. In cases which have lasted for several weeks, the pia mater in places is often very much thickened, owing to cell infiltration and the production of new connective tissue, and it is studded with miliary tubercles, sometimes with small yellow tuberculous nodules; frequently there is arteritis, which is sometimes obliterating.

In the most acute cases the brain substance immediately beneath the pia is intensely congested, slightly softened, and shows under the microscope a superficial encephalitis. The lateral ventricles are usually distended with clear serum, sometimes with serum containing flocculi of lymph or pus; the amount present varies from one to four ounces in each ventricle, being always greater in the subacute cases. The walls of the ventricles may be softened. The distention of the ventricles leads to flattening of the convolutions from pressure against the skull, to bulging of the fontanel, and sometimes to separation of the sutures, if they are not completely ossified.

Tuberculous nodules varying in size from a small pea to a walnut are frequently seen associated with meningitis in older children, but not so often in infants. These nodules may be connected with the meninges, or they may be situated within the brain substance, usually in the cerebellum. The larger ones are classed as brain tumours. Inflammatory products are rarely found in the spinal canal.

Although it is not infrequent to see meningitis without symptoms of tuberculosis elsewhere, I have never failed at autopsy to find other tuberculous lesions in the body. In my own experience the following are those most often met with, given in the order of frequency:

(1) In infants, associated with general or pulmonary tuberculosis; (2) in children from three to twelve years of age, with tuberculosis of the vertebræ, hip, knee, or ankle; (3) at any age, with tuberculosis involving only the tracheal, bronchial, or cervical lymph nodes; (4) much less frequently with the pulmonary tuberculosis of older children. Meningitis has been reported when it was secondary to tuberculosis of the skin or mucous membranes. I have not, however, met with such cases.

Etiology.—Tuberculous meningitis is produced only by the transportation of the tubercle bacilli to the brain. They may find their way by the blood-vessels or lymphatics.

The following table shows the age at which the disease is most frequently observed:

AGE.	Personal cases.	Oxley.*	Total.
Under one year	14	3	17
One to two years	9	16	25
Two to five years	24	26	50
Five to nine years	15	18	33
Nine to sixteen years	5	0	5
Totals	67	63	130

In this series, males were a little more frequently affected than females. In two or three instances traumatism was apparently an exciting cause. Tuberculous meningitis is occasionally seen in young children who were previously healthy, whose family history is free from tuberculosis, and where no exposure can be traced. It is probable that in all such cases there has been latent tuberculosis somewhere in the body, and that the exposure was long antecedent to the symptoms. In the majority, however, this is not the case. There is usually a history of hereditary tuberculosis or of exposure to infection; or there have been previous evidences of tuberculosis in the lungs, bones, or lymph nodes.

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* Liverpool, Medico-Chirurgical Journal, July, 1885.

Symptoms.—In forty-three of sixty-three cases the onset was gradual; but in a considerable number of those classed as sudden, careful inquiry elicited a history of previous indisposition. The most frequent early symptoms are disinclination to play, or drowsiness; sometimes there is constant fretfulness or irritability. Often a distinct change in disposition is seen. In a case recently under observation this was most striking; from being devoted to her mother, a little girl could not endure her presence in the room. There is loss of appetite, and usually constipation. Sleep is restless and disturbed; there may be grinding of the teeth. Older children often complain of headache. At all ages a suggestive symptom is frequent attacks of vomiting without apparent cause. In addition to these there may be a slight but continuous elevation of temperature. Indefinite symptoms may last for four or five days, or they may be spread over two or three weeks without perhaps being sufficiently severe to attract much notice. Finally, unmistakable evidence of brain disease develops, and then it is recollected that symptoms like the above had existed for some time. These early disturbances are often ascribed to dentition, to worms, or to indigestion; and sometimes they are regarded simply as the result of the constipation.

In the midst of such indefinite symptoms there may come an attack of convulsions, and, in the course of a few hours, deep stupor. The early symptoms of the active stage are indicative of cerebral irritation. There is headache, often located in the frontal region, and occasionally photophobia; sometimes there is sudden screaming out at night without waking. The skin is usually somewhat hyperæsthetic; the reflexes are apt to be exaggerated; the muscles of the neck may be rigid and the head is drawn back, or there may be rigidity of one or more of the extremities. The pupils are normal or contracted; there may be nystagmus. The child is fretful, wishes to be left alone, and cries if disturbed; but otherwise is apt to be unnaturally drowsy. Such symptoms may continue for a day or two, or even for a week. If prolonged, they are likely to alternate with periods of more marked apathy and dulness. During this stage there is occasional vomiting, and the bowels are obstinately constipated. The pulse is usually somewhat accelerated, but may be slow and occasionally is irregular. The respiration is of normal frequency, but a careful observation during sleep or perfect quiet will often show a slight irregularity which is very significant. This becomes more marked as the disease progresses. The temperature is invariably elevated, but never very much so, generally being from 99° F. to 101° F. When a high temperature is seen, it is usually due to tuberculosis elsewhere than in the brain.

During the intermediate or second stage, the irritative symptoms subside, and stupor becomes deeper and more continuous. If undisturbed, the child may sleep a great part of the time, but can be roused, and then appears quite rational. Later the stupor becomes so profound that the

child can not be roused at all;
periods of complete lucidity.
slowly to light or not at all; tl
seen strabismus, ptosis, or paral
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disappearing after a day or two
ties, particularly of the arms, ar
noticed. Opisthotonus is mar
the fontanel is tense and bulgi
typical "boat-belly." On draw
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Other vaso-motor disturbances
in the early part of the disease
diminished or abolished. The
often intermittent. The respirat
consists in the movements becc
a long sigh, then a complete arre

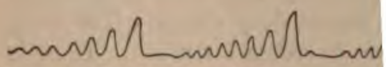

FIG. 114.—Tracing of respiration in tubercu
meningitis.

114). An examination with the
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The duration of this stage is
is irregular, and subject to gre
mental symptoms. Sometimes a
and on the following day will be
Such a course is to be expected
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to twenty-four hours until death.

from two days to a week. Often the patient will live for four or five days in a condition of prostration so extreme that death is hourly expected. A rapidly rising temperature or the occurrence of convulsions indicates approaching death. Of fifty-seven cases, fifty died in coma, seven in convulsions.

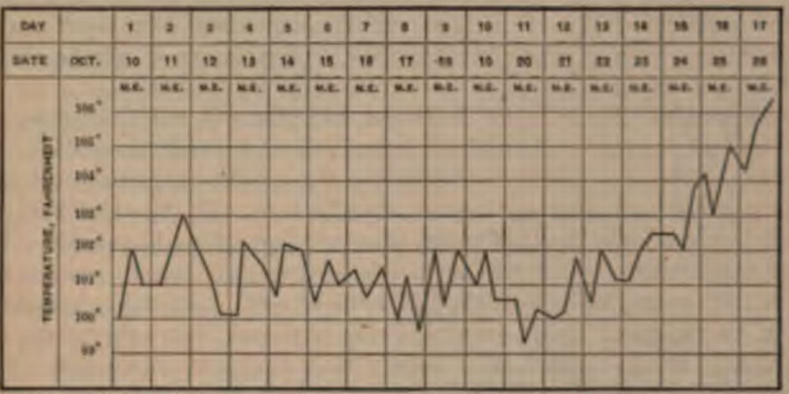

FIG. 115.—Fairly typical temperature curve in tuberculous meningitis; boy, twenty months old; death on seventeenth day.

The entire duration of the disease from the beginning of definite symptoms, in sixty-five of my own cases, was as follows:

One week, or less	17
One to two weeks	15
Two to three weeks	17
Three to four weeks	14
Five weeks	2
	65

Variations in the course of the disease.—There are few diseases which present a greater variety of symptoms than tuberculous meningitis. Typical cases like those above described are seen most frequently in children over two years old, in whom the cerebral symptoms predominate over those of general tuberculosis. In infancy, especially when the disease follows acute tuberculous pneumonia, the duration of the cerebral symptoms may be only three or four days. The stages then are not marked. The onset is usually with convulsions, and in less than twenty-four hours there may be marked stupor, and all the symptoms belonging to the third stage of the disease.

In some cases the course is much longer than that described, the symptoms lasting from four to eight weeks. In character they are much the same as those in the typical cases, except that the irritative symptoms are less marked, and there is less fever. If the child is young, there is great bulging of the fontanel, or even an increase in the size of the head.

child can not be roused at all; or, again, this condition may alternate with periods of complete lucidity. Active delirium is rare. The pupils respond slowly to light or not at all; they may be unequal; occasionally there is seen strabismus, ptosis, or paralysis of the face. More often there is hemiplegia, or paralysis of one arm or leg. Such paralyses are often transient, disappearing after a day or two. Automatic movements of the extremities, particularly of the arms, are frequent. Muscular twitchings may be noticed. Opisthotonus is marked and well-nigh constant. In infants the fontanel is tense and bulging; the abdomen is retracted, giving the typical "boat-belly." On drawing the finger-nail along the skin of the abdomen, there appears, after a few seconds, a distinct red streak one or two inches wide, which remains for three or four minutes. This is the *tache cérébrale*, and while not pathognomonic, it is almost always present. Other vaso-motor disturbances may be seen. The reflexes are variable; in the early part of the disease they are usually increased, later they are diminished or abolished. The pulse now becomes slow and irregular, often intermittent. The respiration assumes the characteristic type, which consists in the movements becoming deeper and deeper until there is a long sigh, then a complete arrest of respiration for several seconds, after which the movements begin again, at first shallow, but gradually increasing in depth until the sigh is repeated. The accompanying tracing illustrates the type (Fig. 114). An examination with the ophthalmoscope usually shows the presence of choked discs.

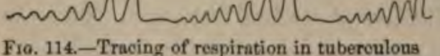

FIG. 114.—Tracing of respiration in tuberculous meningitis.

The duration of this stage is from three to ten days. The progress is irregular, and subject to great variations, especially as regards the mental symptoms. Sometimes a child will be seen in quite deep stupor, and on the following day will be sitting up in bed playing with its toys. Such a course is to be expected, and the physician should never raise any false hopes of recovery because of these periods of temporary improvement.

In the third stage there is complete coma. The child can not be roused at all. The pupils are widely dilated, and do not respond to light. There is general muscular relaxation. There may be retention of the urine. Deglutition is difficult, sometimes almost impossible. The boat-belly and opisthotonus are still marked. The respiration is more rapid, but still irregular. There are sordes on the lips and teeth, emaciation, and anæmia. Toward the end the temperature rises rapidly to 104° F., sometimes to 106° or 107° F. (Fig. 115). The pulse becomes very rapid and feeble, often 160 to 180 a minute. Death usually takes place from exhaustion in deep coma; or convulsions develop and continue from twelve to twenty-four hours until death. The duration of the stage of coma is gitis ever ends in recovery. Such a result is certainly so rare as not to be expected. I have never seen it. In certain cases simple meningitis may so closely simulate the tuberculous variety that a differential diagnosis can not be made, and it is possible that the cases of alleged recovery were simple and not tuberculous. Gibney has reported a case of meningitis occurring in a boy with double hip-joint disease, which certainly, so far as symptoms went, should be classed as tuberculous, and yet recovery took place. The child died several months later, of amyloid disease. I was present at the autopsy, and there was found no trace of cerebral tuberculosis. On theoretical grounds there seems to be no reason why recovery may not sometimes follow from meningitis as well as from other forms of local tuberculosis, but as a matter of clinical observation such a result is extremely doubtful.

Treatment.—From what has been said regarding prognosis, it follows that if the diagnosis is correct the case is practically hopeless, no matter what treatment is employed; but as a positive diagnosis is not always possible, all cases should be treated like those of simple meningitis.

CHRONIC BASILAR MENINGITIS IN INFANTS.

Basilar meningitis is generally tuberculous. Not very infrequently there is, however, seen in infants a chronic form of basilar meningitis which is not tuberculous. Attention was first called to these cases by Gee and Barlow, who in 1878 published, under the title of "Cervical Opisthotonus in Infants," six cases of simple basilar meningitis in which the diagnosis was confirmed by autopsy. Since that time a number of other cases have been reported by various writers. I have followed two such cases to the post-mortem table, one of which was undoubtedly syphilitic. I have seen others of a similar nature which have recovered, one of these also being in a syphilitic infant. Not all these cases are syphilitic, but the etiology of the other cases is unknown.

Lesions.—This process is usually limited to the base of the brain. The pia mater is thickened about the interpeduncular space, also over the medulla, pons, and cerebellum. These different parts may be adherent to each other, or to the inner surface of the dura. The cranial nerves may be compressed. The openings in the fourth ventricle are usually obliterated, and there results a distention of the lateral ventricles with clear serum, sometimes in sufficient amount to be regarded as hydrocephalus. Rarely, pus may be found in the ventricles. The lesions thus are very much like those seen in the protracted cases of tuberculous meningitis, minus the tubercles.

Symptoms.—These in all cases are quite uniform. The two most prominent symptoms are cervical opisthotonus and moderate hydrocephalus. The opisthotonus is constant and may be quite extreme. In one of my cases the cervical spine for weeks formed nearly a right angle with the

In older children the symptoms are chiefly those of a general pressure upon the cortex. These are due to the great accumulation of fluid in the lateral ventricles. The symptoms of general compression are persistent drowsiness, but rarely deep coma, rigidity of all the extremities, and sometimes paralysis. The pupils are usually contracted, but there are no symptoms which are distinctly focal. Opisthotonus is nearly always marked in these cases.

Diagnosis.—There are no diagnostic symptoms in the first stage. If the patient has previously suffered from local or general tuberculosis, and symptoms develop which are enumerated as prodromal, meningitis may be suspected with a strong degree of probability. If the child has previously given no evidence of tuberculosis, a diagnosis is impossible. The indefinite symptoms that belong to the early stage of the disease are frequent in young children suffering from chronic indigestion associated with constipation. In nine out of every ten cases, such will be the explanation of the indisposition rather than incipient meningitis. Disturbances of nutrition, classed as cyclic vomiting (page 287), may present many of the symptoms of meningitis. I have seen two cases in which a differential diagnosis was impossible for two or three days.

The most frequent symptoms of tuberculous meningitis enumerated in the order of their occurrence in fifty-eight cases, were as follows: obstinate constipation, persistent drowsiness, irregular respiration, vomiting without apparent cause, irregular pulse, convulsions, opisthotonus, and fever which was usually slight. Equally important for diagnosis, and especially significant when associated with the above, are strabismus, facial paralysis, and loss of the pupillary reflexes.

The discovery of tubercle bacilli in the fluid drawn by lumbar puncture (page 713) is conclusive. However, this does not add greatly to our means of diagnosis, as the bacilli are never numerous and always difficult to find, and in a number of undoubted cases they can not be found at all. Without finding bacilli we may be quite certain, from the other conditions present, that meningitis exists, but we can not with any certainty separate the simple from the tuberculous cases. The symptoms which distinguish these from each other have already been considered (page 713).

The cerebral symptoms of ileo-colitis and other diarrhœal diseases, sometimes closely resemble those of tuberculous meningitis; but whenever in a young child there is another disease present which may furnish an explanation for the cerebral symptoms, the diagnosis of meningitis should be made with great caution. The development of meningitis in the course of an ordinary attack of pneumonia may simulate very closely pulmonary tuberculosis with tuberculous meningitis. A diagnosis may be impossible during life. In doubtful cases the probabilities are greatly in favour of tuberculosis, since it is so much more common.

Prognosis.—It is still a matter of dispute whether tuberculous menin-

and is not accompanied by any enlargement of the head, or by other cerebral symptoms.

Treatment.—This consists in the administration of potassium iodide. Although this has little or no influence upon cases not syphilitic, it may cure those which are syphilitic. As it is impossible to distinguish between syphilitic and non-syphilitic cases, every child should have the benefit of a thorough trial of this drug in full doses. At least fifteen grains daily should be given for several weeks to an infant six months old, and still larger doses if the stomach will tolerate it.

THROMBOSIS OF THE SINUSES OF THE DURA MATER.

This is not very frequent. It may depend upon certain general conditions, when it is usually classed as cachectic or marantic thrombosis; it may be associated with local pathological processes, when it is known as inflammatory or septic thrombosis.

Cachectic Thrombosis.—This is seen in infants and young children, but is very rare after the age of five years. It occurs in the course of various diseases, the most frequent being pneumonia, pertussis, diphtheria, nephritis, tuberculosis, and the acute intestinal diseases. In connection with the last-mentioned group, altogether too much has been made of it, as it is really rare, and in only a very few cases does it explain the cerebral symptoms present. This statement is made from personal observations upon over two hundred autopsies upon cases of acute intestinal disease. The actual cause of the thrombosis is the altered condition of the blood and the feeble circulation, as the walls of the sinuses are normal.

The most frequent seat of cachectic thrombosis is the superior longitudinal sinus. At autopsy one must be careful not to confound the soft, partly-decolorized, non-adherent thrombi of post-mortem origin, with those of ante-mortem formation. The latter are firm, and when of long standing may be very hard and even show a laminated structure. They usually fill the sinus completely, and are adherent. The thrombus extends from the sinuses to the veins emptying into it, which stand out like dark worms upon the surface of the brain. The brain itself may be deeply congested, or it may be covered with a diffuse hæmorrhage, but more frequently the brain and the membranes are simply œdematous.

The *symptoms* of cachectic thrombosis are few and uncertain, and in a large number of cases the disease is latent. Very rarely is a positive diagnosis possible during life. When the thrombosis occurs just before death, its symptoms are so mingled with those of the original disease that they can not be separated. In some cases there may be localized or general convulsions, or paralysis, loss of consciousness, and strabismus.

The *prognosis* is bad, cases generally proving fatal in the course of a few days. The diagnosis is so uncertain and obscure that the *treatment*

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local condition.

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localized œdema ; when the cavern

trusion of the eyeball of the affected side, œdema of the lid, and with the ophthalmoscope the retinal veins appear enlarged and tortuous, sometimes being the seat of thrombosis. The process may affect either one or both sides. The course of septic thrombosis is rather irregular, varying from a few days to three weeks. In fatal cases death takes place from meningitis, cerebral abscess, or pyæmia. The prognosis is very grave, unless the disease is so situated that it is accessible to surgical operation.

Treatment.—The only successful treatment is surgical. Operation is easiest in thrombosis of the lateral sinus, being much more difficult if involving the superior longitudinal sinus. So many cases are now on record of successful operation upon septic thrombosis of the lateral sinus, that it should always be urged when the diagnosis is clear. Recurring chills and high, fluctuating temperature, associated with disease of the ear, either with or without symptoms of meningitis, are sufficiently characteristic to justify operative interference.

CEREBRAL ABSCESS.

Cerebral abscess is quite rare in children, decidedly more so than is cerebral tumour. In Gowers' collection of 223 cases, only 24 were under ten years of age. In infants, abscess is one of the least frequent diseases of the brain, and up to five years it is exceedingly rare.

Etiology.—By far the most frequent cause in children is otitis. This is the origin of the great majority of the cases. Abscess rarely complicates acute otitis, but is seen with the chronic form. Exactly how otitis causes cerebral abscess it is not always easy to determine. Toynbee was the first to call attention to the fact that cerebellar abscess was most frequent with disease of the mastoid cells, and cerebral abscess with otitis media. Usually there is caries of the petrous bone, but there may be none. The infection may extend through the small veins traversing this bone, or along the lateral sinuses to the cerebellum. Abscess is often attributed to the retention of pus in the ear, but it may occur when the discharge is free.

Traumatism is the second important etiological factor. Abscess may be associated with fracture of the skull, or follow simple concussion. The abscess is generally in the neighbourhood of the injury, but occasionally is produced by *contre coup*. In one instance, reported by Wagner, thrush was believed to be the cause of cerebral abscess, the same fungus that existed in the mouth being found in the brain, which in this case was studded with small abscesses. Abscess may be the result of infectious emboli, associated with general pyæmia, though this is rare in early life; and finally it may occur without any assignable cause.

Lesions.—The most frequent seat of the abscess is, first, the temporo-sphenoidal lobe; secondly, the cerebellum; thirdly, the frontal lobes. Other locations are very rare. Abscesses are usually single. In size they must be symptomatic, and directed toward the general rather than the local condition.

Inflammatory Thrombosis—Septic Thrombosis—Sinus-Phlebitis.—This condition is most frequent in children in connection with acute meningitis. It may exist either with the simple or the tuberculous variety. It also follows otitis—especially old and neglected cases—usually with necrosis of the petrous bone, but sometimes without it. It is much less frequently associated with disease of the ear in children than in adults. It may arise from traumatism, necrosis of the cranial bones, or from septic processes involving any of the cavities or any of the structures adjacent to the brain, such as the scalp, orbit, nasal fossa, mouth, or pharynx. Infection from the mouth or pharynx is most frequent in children in connection with scarlet fever or diphtheria; while usually secondary to otitis it may occur without it, the infection being carried by the blood-vessels. Infection from the nose may have its origin in ulceration from syphilis or tuberculosis. In the orbit, the source may be malignant disease.

The seat of the thrombosis will depend upon the original disease. If this affects the cranial bones or the scalp, it will be the longitudinal sinus; if the ear, the lateral sinus; if the base of the skull, the orbit, the mouth, the jaw, or the nose is affected, it will be the cavernous sinus. When thrombosis occurs with meningitis the lesions are much the same as in the cachectic form, with the exception that there are sometimes slight changes in the walls of the sinuses. If the patient has suffered from a local septic process, there may be puriform softening of the clot, and general pyæmia, with the development of secondary abscesses in the brain, in the lungs, and in other organs. With such cases there may be associated a general or localized meningitis.

Symptoms.—The symptoms of septic thrombosis are more decided than those of the cachectic form. When occurring in the course of meningitis, it usually adds no new symptoms to those of the original disease. In the pyæmic form the symptoms are more characteristic, particularly when associated with otitis. There are recurring chills with very high and widely-fluctuating temperature. There is headache, and often localized tenderness of the scalp; the other symptoms which are present are usually the same as those of meningitis. If metastasis occurs, there may be evidences of abscesses of the brain or in other organs, and sometimes there are signs of suppuration in the jugular vein.

The local symptoms of the thrombosis differ somewhat according to the sinus affected: if its seat is the superior longitudinal sinus, there may be cyanosis of the face, dilatation of the temporal and frontal veins, and sometimes epistaxis; if the lateral sinus is involved, the process may extend to the jugular vein, which may be felt in the neck as a hard cord, and there may be dilatation of the veins of the mastoid region, and even localized œdema; when the cavernous sinus is affected, there may be pro-

The local symptoms of abscess are rather indefinite, owing to its usual situation. Abscesses of considerable size may exist in the temporo-sphenoidal lobe, in the central part of the frontal lobe, or in the cerebellum, without any definite local symptoms. If the abscess is near the motor area, there are the usual symptoms of disease in this location, spasm, or paralysis of the face, arm, or leg. A cortical or sub-cortical abscess is likely to cause convulsions. Cerebellar abscess may give rise to occipital headache, frequent vomiting, and when the abscess is large enough to press upon the middle lobe, there may be inco-ordination of the muscles of the extremities. Optic neuritis may be present, but other symptoms relating to the cranial nerves are rare. Localized tenderness over the scalp, when persistent, is a symptom of importance, and may serve to locate the abscess, if it is superficial.

Diagnosis.—Of the general symptoms, the most important for diagnosis are fever, headache, delirium, and terminal coma. These become particularly significant when following otitis or traumatism. The differential diagnosis of abscess is to be made principally from tumour and meningitis, and from these conditions more by the history and general course of the disease than by any special symptoms. The diagnosis of abscess from tumour is considered in connection with the latter disease. It is more difficult to distinguish between meningitis and abscess, since the two processes are often associated. With meningitis convulsions are more common, but they are rarely localized; rigidity and the inflammatory symptoms are more intense; the course is usually more rapid and more regular, being rarely interrupted, as is the course of abscess. From the cerebral symptoms occurring with otitis it is extremely difficult to distinguish abscess, for, according to Gowers, optic neuritis may be present in the former as well as in the latter condition. The more intense and prolonged are the cerebral symptoms and the more marked the neuritis, the greater are the probabilities of abscess.

Prognosis.—The prognosis in cerebral abscess is always grave, unless accessible to surgical operation. The progress may be slow, or rapid, but it is inevitably from bad to worse, and sooner or later the disease, if not interfered with, proves fatal.

Treatment.—The medical treatment of abscess in its active stage is that of any acute intracranial inflammation,—ice to the head, absolute quiet, free catharsis, and full doses of the bromides or antipyrine or morphine, if pain is intense. The absolutely hopeless condition of these cases when left to themselves, and the recent brilliant results from surgical operations, should lead the physician to urge operation in every case.*

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* For a discussion of the surgical aspects of this question, see "Brain Surgery," by M. Allen Starr, M. D., and "Pyogenic Infectious Diseases of the Brain and Cord," by William McEwen, M. D.

vary from that of a small cherry to an orange. One case was observed by Meyer, in which an abscess occupied one entire hemisphere. The contents are usually thick greenish-yellow pus, which may be very fetid. When abscesses have lasted for some time they are usually surrounded by dense pyogenic membrane, and may become encysted. The pathological process may be slow, and often is apparently stationary for a long period. Abscesses may rupture into the ventricles, less frequently upon the surface of the brain, causing meningitis, or the pus may even escape externally through the auditory meatus, as in Lallemand's case.

Symptoms.—These are general and local. The general symptoms are much the more important for diagnosis, and often are the only ones present. The local symptoms are those of a tumour. The clinical history of a case of abscess of the brain may be divided into three stages: First, the period of onset, or early acute inflammatory symptoms, fever, etc., which attend the formation of pus. Secondly, the latent period, or period of remission, in which very few symptoms are present. In many acute cases this stage is wanting altogether; in the chronic cases it may last for months, or even years. Thirdly, the final period, with recurrence of active cerebral symptoms, followed by death in a few days.

The onset may be accompanied by symptoms so slight as almost to escape notice. In most cases, however, headache and fever are present. The headache is usually severe, and often localized upon the affected side; in cerebellar abscess it may be occipital. The fever is moderate in intensity, and continuous. In addition there may be vertigo, vomiting, general convulsions, and cessation of the aural discharge, if one has been present. The duration of this stage is variable; it may be only a few days, or several weeks. It is shorter in traumatic cases, and in those which are due to pyæmia.

The latent stage, or period of remission of symptoms may be quite short—only a few days' duration—and it is often absent. During this period the temperature may fall quite to the normal, and the headache disappear, or be only occasional and slight. However, if any focal symptoms have been present they remain unchanged.

The symptoms of the terminal stage are due to a rapid extension of the inflammatory process, with œdema and softening about the abscess, sometimes to rupture into the ventricle, and sometimes to meningitis. The fever now returns, and may be high. There is headache, often very intense and continuous; there may be delirium and convulsions, and the gradual development of coma. In addition there may be vomiting, paralysis, opisthotonus, retracted abdomen, and the other symptoms of meningitis. Occasionally all the earlier symptoms may be latent, and the terminal symptoms may be the only ones present. In infants, the fontanel is usually large and bulging; convulsions are rather more frequent than in older children.

Sarcoma may be of the spindle-celled or the mixed variety. It grows much more rapidly than glioma. The two varieties are not infrequently combined in the same tumour—glio-sarcoma.

Cystic tumours are sometimes sarcomatous in origin, the wall of the cyst containing sarcoma cells, and they may also be parasitic, from the growth of the echinococcus. They may be found in any part of the brain.

The other varieties of sarcoma, gumma and vascular tumours, are exceedingly rare until after puberty.

As the tumour grows, secondary lesions are produced in most of the cases. These are the result of pressure upon arteries, causing localized anæmia, or even cerebral softening; or upon veins, producing congestion and œdema. When affecting the middle lobe of the cerebellum, pressure upon the venæ Galeni may lead to effusion into the ventricles. Localized meningitis over tumours superficially situated is the rule, and this may be the cause of some of the symptoms. Rarely, cerebral hæmorrhage may be associated.

Etiology.—The causes of cerebral tumours are for the most part unknown. In a few instances there is a history of definite traumatism. Sarcoma or carcinoma may be secondary, and tuberculous tumours are probably always so.

Symptoms.—These may be divided into two groups: first, the general symptoms which are common to tumours of all varieties, and are independent of location; secondly, the local symptoms depending upon the situation of the growth.

General symptoms.—One of the most frequent is headache. Though it varies much in its severity, character, and position, it is rarely absent. It is apt to be severe, and may continue for a long period, or it may be intermittent. The location of the pain has no definite relation to the situation of the tumour. It may be accompanied by sensations of tightness compression, or tension in the head. It may be associated with localized tenderness of the scalp; when this is constant it is a valuable symptom for diagnosis, as it often occurs with tumours superficially located.

General convulsions often occur in the early stage, but separated by quite long intervals; they become more frequent and more severe as the disease progresses. All degrees of severity are seen, from slight twitchings and temporary loss of consciousness, to typical epileptiform seizures. They are most common when the growth is rapid and when complicating meningitis is present. Attacks of localized spasm may for a considerable time precede general convulsions; and in a single attack there may be first localized and then general convulsions.

Mental symptoms are generally present in great variety and complexity. There may be only fretfulness and irritability, or a marked change in disposition. These symptoms are so frequent from other causes in children that they excite no apprehension, unless to them are added dulness,

CEREBRAL TUMOUR.

Very little has been added to our knowledge of cerebral tumour in children since the exhaustive monograph of Starr, which appeared in Keating's Cyclopædia in 1890. It is to this article that I am indebted for most of the facts in this chapter.

Varieties and Location.—Tumour of the brain is not very infrequent, and may be seen even in infancy. From this time up to puberty there is no period of special susceptibility. In two hundred and sixty-nine of the cases in Starr's collection, in which the nature of the tumour was stated, the following were the varieties:

Tubercle	152	cases.
Glioma	37	"
Sarcoma	34	"
Glio-sarcoma	5	"
Cyst	30	"
Carcinoma	10	"
Gumma	1	"
	269	"

Tuberculous tumours are more often multiple than are other varieties. Their most frequent seat is the cerebellum; next to this the pons and crura cerebri. They are rarely cortical or central. Glioma is most often found in the cerebellum or in the pons, and next in the cortex; but it is rarely central. Sarcoma is most frequently in the cerebellum; next to this, in the order of frequency, in the pons, the basal ganglia, and the cortex. Cystic tumours are either central or cerebellar. Taking the cases as a whole, the most frequent seat of tumour in children is, first the cerebellum, second the pons, third the centrum ovale.

Tuberculous tumours are occasionally seen in infancy, but they occur most frequently between the ages of five and twelve years. They are usually secondary to tuberculosis elsewhere, especially in the lungs and in the bronchial lymph nodes. They most frequently start from the membranes, rarely being centrally situated, and extend inward, infiltrating the superficial portion of the cerebellum or cerebrum. There is almost invariably localized meningitis at the site of the tumour; there may be adhesions between the dura and pia mater, and the disease may extend to the cranial bones. In size, these tumours vary from a small pea to a child's fist. They may be softened and broken down at the centre, or cheesy throughout. They are the result of a localized tuberculous inflammation, which does not differ essentially from that seen in other parts of the body.

Glioma is not infrequent in infancy. It is probably connected in every case with the ependyma of the ventricle. It repeats the structure of the neuroglia, being composed of connective tissue and branching cells.

until all three are involved. There is no loss of consciousness, but there may follow a slight transient paralysis. Such attacks are known as "Jacksonian epilepsy," and form one of the most diagnostic symptoms of cerebral tumour. Localized spasm may be associated with anæsthesia or other disturbances of sensation. The paralysis generally first affects one extremity—the arm or leg, according to the location of the tumour—and afterward it may involve the entire side, including the face.

If the tumour is centrally located, or at the base, hemiplegia may be an early symptom from pressure on the motor tract. With cortical paralysis there may be associated ataxia and anæsthesia.

Tumours of the parietal lobe may give no local symptoms. At times there are disturbances of muscular sense, tactile sensibility, or sensations of pain and temperature. If the inferior parietal lobule of the left side is affected, there may be word-blindness, or inability to understand written language.

Tumours of the occipital lobe produce, as the only constant local symptom, hemianopsia. This is usually bilateral, affecting the same side of both eyes, being on the side opposite to that of the lesion—i. e., a tumour on the right side causes blindness in the left half of both eyes, so that the patient sees nothing to the left of a line directly in front of him. Instead of hemianopsia, there may be only irritation and various disturbances of sight.

Tumours of the temporo-sphenoidal lobe may be latent, or, if on the left side, may cause word-deafness—i. e., inability to understand the significance of spoken language.

Tumours in the island of Reil when situated upon the left side (right side in left-handed persons) may cause motor aphasia or disturbances of speech. If they are large they may produce symptoms by pressure upon the motor tract,—hemiplegia or monoplegia.

Tumours of the basal ganglia cause marked general symptoms, but none of a definitely local character. The important symptoms relate to the various tracts or bundles of fibres which pass from the cortex through the internal capsule. These include the motor and the various sensory tracts, the olfactory, auditory, visual, and speech tracts. Any of these may be pressed upon, and the nature of the symptoms will depend upon the size of the tumour and the extent of the pressure. If only the anterior part of the capsule is affected there may be no symptoms; if the middle fibres, hemiplegia and disturbances of articulation; if the posterior fibres, hemianæsthesia. All these may be associated, and any of them may be complete or partial. Tumours in this situation are apt to implicate the cranial nerves. Optic neuritis is quite constant, and appears early. Localized or general convulsions are rare.

The peculiar symptoms pointing to tumours of the crura cerebri are nystagmus, strabismus, and loss of pupillary reflex, sometimes with general apathy, and somnolence. Later in the disease there may be attacks of hypochondriasis, or of melancholia; there may be periods of wild, almost maniacal excitement; and, finally, the mental impairment may approach a condition of imbecility.

Optic neuritis and optic-nerve atrophy are very frequent, occurring, according to Starr, in eighty per cent of the cases. This is only recognised by the ophthalmoscope, as there may be no disturbance of vision. The optic neuritis is generally double, appears earlier, and is more constant in basal tumours than in those at the convexity, or those centrally located.

Vomiting is very frequent, but diagnostic only when it occurs suddenly without assignable cause, and without nausea or other symptoms of indigestion. It is especially significant when frequently repeated, and of more importance in older children than in infants.

Vertigo is often associated with vomiting. At first it is occasional and seen upon changing position, but later it may be quite constant, especially with tumours in the posterior fossa.

Disturbances of sleep are frequent. There is usually insomnia, but sleep may be broken by hallucinations, accompanied by attacks of screaming; rarely is there persistent drowsiness until toward the end of the disease.

Local symptoms.—These depend upon the situation of the tumour, but not at all upon its anatomical character. Local symptoms may be wanting entirely, and they may vary much in different cases even with tumours in the same situation. They are modified by the size and by the rapidity of growth, and by the existence of local meningitis.

In tumours of the cortex, the meninges are likely to be involved, especially with tuberculous and gliomatous growths. The pathological process may extend from within outward or from without inward. The most frequent general symptoms in such cases are headache, circumscribed tenderness of the scalp, convulsions, and mental symptoms. Optic neuritis, vomiting, and vertigo are not so common. Tumours situated in the frontal lobe, as a rule, present few symptoms and may be entirely latent. Irritation of the frontal lobe may extend to the motor area and cause convulsions either local or general; but not often is there paralysis. Tumours of the left side (of the right side in left-handed persons) in the third frontal convolution may cause motor aphasia.

Tumours in the motor convolutions along the fissure of Rolando produce the most definite and uniform local symptoms. When situated at the upper portion the leg is affected, at the middle portion, the arm, and at the lower, the face. Irritative symptoms, such as rigidity or clonic spasm, commonly precede for some time the paralysis which results from pressure or destruction. These attacks of localized convulsions may begin in the face, arm, or leg; but they usually extend more or less rapidly much importance; but some information upon this point may be gained from the consideration of its etiology, the rapidity of its growth, and the age of the patient. Cerebral tumour may be confounded with abscess, tuberculous meningitis, chronic basilar meningitis, and chronic hydrocephalus. The symptoms distinguishing tumour from abscess are the following: Tumour may occur at any age; without definite etiology, excepting when tuberculous; the progress is steady, but generally slow, new symptoms being continually added; headache is more constant and more severe; optic neuritis more frequent; cranial nerves more often involved; mental disturbances more marked; focal symptoms are often definite; fever is absent; duration, six months to two years. As compared with the above, abscess is not so frequent, being especially rare in infancy; there is a definite history of traumatism or ear disease; progress more irregular; symptoms often intermittent; headache less severe; mental symptoms less marked; optic neuritis and involvement of the cranial nerves less frequent; focal symptoms usually indefinite; localized tenderness over the scalp more constant; fever present except in the latent period; the most frequent complication is acute meningitis.

Cases of tuberculous meningitis which may be confounded with tumour are those of slow course sometimes seen in older children. The difficulty in diagnosis is increased by the frequent association of tuberculous tumours with tuberculous meningitis. The main points of difference are that in tumour the symptoms are more localized and the course generally much slower. Almost every individual symptom, however, may be present in the two conditions.

Chronic basilar meningitis may produce symptoms almost identical with those of tumour in the posterior fossa. It is, however, confined to infancy, and is frequently syphilitic. Hydrocephalus and opisthotonus are much more marked than are usually seen with tumour.

Chronic hydrocephalus may resemble tumour; this occurs so frequently as a lesion secondary to tumour that the question often arises whether there is only hydrocephalus, or there is in addition a tumour. Primary hydrocephalus is usually congenital, and the symptoms appear during the first year. It commonly attains to a greater degree than is seen in secondary hydrocephalus; but the symptoms in the two forms may be identical.

Prognosis.—The prognosis in cerebral tumour is absolutely bad; except in syphilitic cases, which are among the rarest forms seen in childhood, there is no prospect of recovery, and but little of improvement. The symptoms usually progress steadily from bad to worse, and more rapidly in children than in adults. Death occurs from exhaustion, coma, convulsions, or from respiratory failure, sometimes suddenly from unknown causes.

Treatment.—If there is any reason to suspect syphilis, the iodide of potassium should be given in large doses and continued for a long period;

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beginning in the latter months of intra-uterine life. Some of these cases are clearly syphilitic. D'Astros[*] has collected nine cases and added three others, in which hydrocephalus was associated with lesions undoubtedly syphilitic. When due to syphilis, the disease may at the same time be congenital. Rickets and hydrocephalus are occasionally associated, but so infrequently as to make a definite etiological connection between them very doubtful. The rachitic head has been so often mistaken for hydrocephalus that an erroneous notion has arisen as to the frequent association of these two diseases. This point will be referred to more fully under diagnosis. Chronic hydrocephalus is often attributed to tuberculosis, but here again the connection is a very doubtful one. Heredity is a factor of some importance; numerous instances are on record where two children in the same family have been affected. Hydrocephalus not infrequently develops after successful operations upon spina bifida or encephalocele.

Lesions.—The difference between the primary and secondary cases is chiefly one of degree. The amount of fluid in secondary cases is rarely more than three or four ounces. In primary cases it is usually from half a pint to one pint, but it may be very great. In one of my own cases there was removed from the head of a child, who died at four months, five pints of fluid. Larger quantities than this have been reported, but not at so early an age. In composition this resembles the cerebro-spinal fluid. An examination in one of my cases showed it to be a clear, translucent fluid, slightly alkaline in reaction, specific gravity 1005, containing sodium and potassium chlorides, alkaline phosphates, and a trace of albumin. In some specimens sugar is found. In cases of inflammatory origin the amount of albumin is generally larger, and the fluid may be slightly turbid. The effusion may become purulent from accidental infection resulting from operation, from rupture, or, as in one of my cases, from infection through the sac of a spina bifida with which it was complicated, the process extending to the brain through the central canal of the cord.

The changes in the brain result from the gradual accumulation of fluid in the ventricles. The septum lucidum is usually broken down, and all the avenues of communication between the ventricular cavities are greatly enlarged. The continuous distention results in a gradual thinning of the brain substance which forms the ventricular walls; often these are found only one fourth of an inch in thickness, or even less than this, the cortex being a mere shell (Fig. 117). In one of my autopsies the ependyma of the ventricle and the pia mater were in places actually in contact, all of the brain tissue having been absorbed; the brain resembled a large double cyst. In a case of Peterson's, with the exception of a small portion of one temporo-sphenoidal lobe, all the effect of this drug even in tumours not syphilitic is sometimes beneficial. Starr refers to a case in which symptoms of six months' duration, including optic neuritis, entirely disappeared under the use of mercury and the iodide. The tumour was supposed to be gumma, but an autopsy obtained six months later showed it to be a sarcomatous cyst. For a discussion upon the surgical aspect of the treatment of brain tumours, the reader is referred to Starr's work on Brain Surgery.

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[*] Revue Mensuelle des Maladies de l'Enfance, ix, 481, 543.

HYDROCEPHALUS.

Hydrocephalus or "water on the brain," consists in an accumulation of serum in the cranial cavity. This may be between the dura mater and the pia (external hydrocephalus) or in the ventricles of the brain (internal hydrocephalus). The former is secondary and is quite rare, while the latter is not uncommon. Hydrocephalus may be acute or chronic.

Acute Hydrocephalus is secondary to basilar meningitis, which is usually of tuberculous origin. The terms tuberculous meningitis and acute hydrocephalus are sometimes used synonymously. A moderate distention of the ventricles is frequent in all varieties of acute meningitis. The amount of fluid in acute hydrocephalus is not great, there being rarely more than three or four ounces present.

Chronic External Hydrocephalus is extremely rare, and is probably always a secondary lesion. It is found with certain congenital malformations and with atrophy of the brain, and it may follow meningeal hæmorrhage or pachymeningitis. On incising the dura mater a few ounces, or sometimes even a pint, of serum may escape. The convolutions are somewhat flattened, and may be greatly atrophied. Other lesions are found either in the brain or in the dura mater. There may be some degree of internal hydrocephalus associated. External hydrocephalus may cause enlargement of the head and separation of the sutures, and in fact most of the symptoms of the internal variety; but usually it is not severe enough to give rise to any decided symptoms. It is so rare that it need not be considered at length.

CHRONIC INTERNAL HYDROCEPHALUS.

This is the important variety, and when no qualifying term is mentioned this is the form of hydrocephalus which is always understood.

Etiology.—This occurs both as a primary and a secondary condition. When secondary it is usually associated with tumours of the base of the brain or with chronic basilar meningitis, either simple or tuberculous. It is in these cases a mechanical condition caused by pressure which obliterates the openings from the lateral ventricles into the fourth ventricle, or the foramen of Magendie.

The causes of primary hydrocephalus are as yet very little understood. In a large proportion of the cases the disease is congenital, generally

Hydrocephalus, with the exceptions mentioned, is recognised by the increased size of the head. In order to estimate the amount of enlargement, it must be remembered that at birth the circumference of the normal head is about 14 inches, and at one year from 18 to 19 inches. The degree of enlargement in hydrocephalus may be very great. In one of my cases, the head at four months measured 24½ inches. In another at ten and a half months, 26¾ inches (Fig. 118). Steiner has reported a remarkable case in which the head at eight months measured 32¾ inches When the enlargement of the head is not great the diagnosis is not so easy. Hydrocephalic enlargement is commonly symmetrical and in all directions. The head is sometimes globular in outline (Fig. 118) and sometimes pyramidal (Fig. 119). The forehead is exceedingly high and projecting, and there is a prominence at the root of the nose seen in no other form of enlargement. The sutures may be separated from half an inch to two or three inches; the fontanel is very large, tense, and bulging;

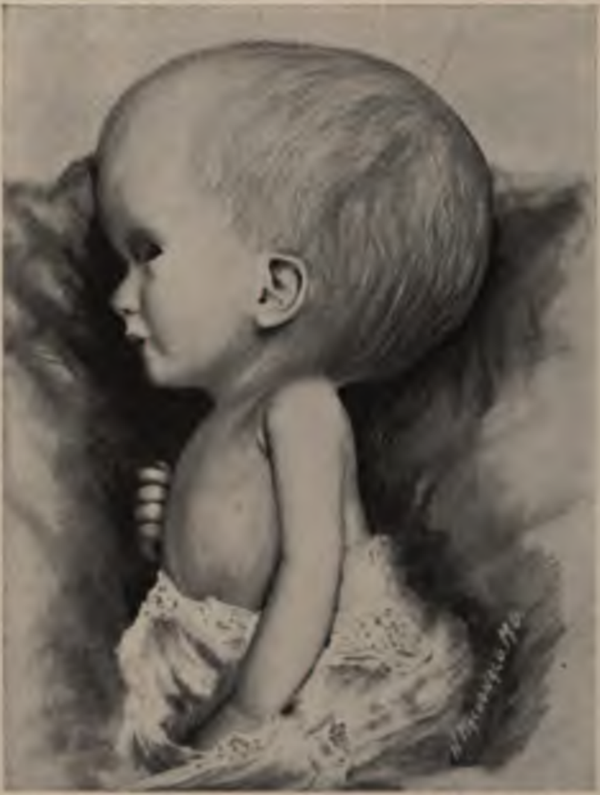

FIG. 118.—Chronic hydrocephalus of a severe type; head of a globular shape; child, ten and a half months old.

of both hemispheres had disappeared, the cerebellum and basal ganglia alone being intact. The brain is always anæmic, and the gray and white substance may be indistinguishable. The changes are largely mechanical, the microscope showing, in my case just referred to, only granular matter and round nuclei evidently from broken-down nerve cells. In less severe cases the changes may be slight. It is, however, always surprising to see the amount of compression which the cortex will tolerate without interference with its functions, provided the pressure comes gradually. The ependyma may be normal, but it is usually somewhat thickened and pale, sometimes granular, and may be infiltrated with new cells. When infection takes place an acute ependymitis may be set up. Chronic inflammation of the ependyma is thought to be the essential lesion in many of the primary cases, whether of simple or syphilitic origin.

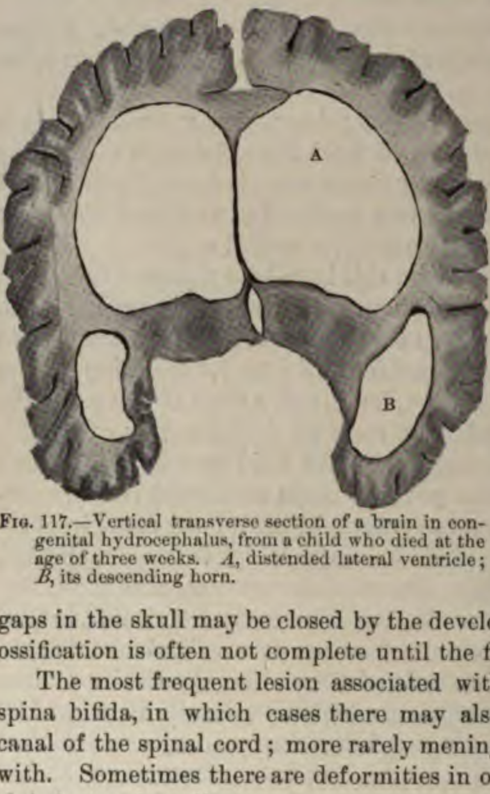

FIG. 117.—Vertical transverse section of a brain in congenital hydrocephalus, from a child who died at the age of three weeks. *A*, distended lateral ventricle; *B*, its descending horn.

The bones of the skull are markedly affected; the sutures at the vault are widely separated, and sometimes even those at the base. After the removal of the fluid the head collapses, giving an appearance which has been well likened to a bag of bones. It should not be forgotten, however, that hydrocephalus may coexist with premature ossification, in which case the head may be small. In the cases which recover, the wide gaps in the skull may be closed by the development of wormian bones; but ossification is often not complete until the fifth or sixth year.

The most frequent lesion associated with congenital hydrocephalus is spina bifida, in which cases there may also be a patency of the central canal of the spinal cord; more rarely meningocele or encephalocele are met with. Sometimes there are deformities in other parts of the body, such as club-foot or hare-lip.

Symptoms.—Hydrocephalus may exist with a small head. In this condition there is usually premature ossification of the cranial bones. Four such cases have come under my notice, one child having lived to be fourteen months old. These children are usually idiotic, and die at an early age, often from convulsions. In such cases other malformations of the brain are frequently associated.

muscles of the extremities due to a slight general paresis, but more often there is rigidity, which is usually most marked in the legs, but sometimes in the arms; the hands are often clenched, with the thumbs adducted; the reflexes are exaggerated; the pupils are generally contracted and equal, though they may be dilated; nystagmus and convergent strabismus are often present. Convulsions may occur from time to time, or may be deferred until near the close of the disease. As the head enlarges the body usually wastes, and the disproportion between the two may seem greater than it really is.

Such congenital cases rarely see the end of the first year, and are often fatal during the first six months. The causes of death are marasmus, convulsions, and intercurrent disease, rarely rupture of the head.

In the cases which develop more slowly, the symptoms are quite different. The head may not attain at eighteen months the size reached in the other cases at the third or fourth month. The surprising thing about many of these cases is that the distinctly cerebral symptoms are so few. Where the pressure develops gradually, the brain seems able to tolerate an almost indefinite amount of it. The more readily the bones of the skull yield to pressure the fewer are the nervous symptoms; hence, other things being equal, they are less marked where the disease begins before the sutures are firmly ossified than in the later cases. A comparatively small amount of effusion may cause very marked symptoms in a child two or three years old, while a much larger amount in an infant of a year, may produce much less disturbance. It is for this reason that secondary hydrocephalus causes such striking symptoms, although the accumulation of fluid is small.

Whether the progress of these cases is slow or rapid, the development of the children is greatly retarded. Many are not able to support the head until two or three years old; frequently they do not walk until five or six years old. The special senses are generally not noticeably affected, but intelligence in most cases is interfered with,—in some only slightly, in others very markedly, while some are idiotic. Contractions of the extremities are occasionally seen, but usually more of the hands than the legs. Sensation is not often affected. The course is a very chronic one. From time to time there are exacerbations of the symptoms, and even intercurrent meningitis may be excited.

Prognosis.—Recovery is rare. It is quite exceptional that a hydrocephalic child reaches the age of seven years. In some cases the process goes on up to a certain age and then ceases spontaneously, and the child may go through life with a head very much larger than normal, usually with a mental condition somewhat impaired. Retrogression of the symptoms is, however, never to be looked for.

Diagnosis.—The most important symptom is the enlargement of the head, and this can only be arrived at by careful measurement and com-the veins of the scalp are enlarged and prominent. In marked cases fluctuation may be readily obtained, and the head may even be distinctly translucent.

In the acquired form all these symptoms are less marked, and if ossification of the skull has taken place it is often impossible to discover any increase in size. The rate of growth of the head varies much in different cases, and it is the surest measure of the progress of the case. The increase in circumference is usually from one to three inches a month.

The primary cases are for the most part of congenital origin, and the child may die *in utero*. At other times the process may have advanced so far before birth that puncture of the head is necessary before delivery is possible. In perhaps the majority of cases no symptoms are observed at birth, or the head is only slightly larger than normal. Usually nothing is noticed until the child is two or three months old, when it is discovered that the head is increasing in size at an abnormal rate. If the progress is rapid, other symptoms are soon evident: the infant can not hold up its head; it is lethargic, and all its perceptions are dulled, sight and hearing included; there may be a general flaccid condition of all the

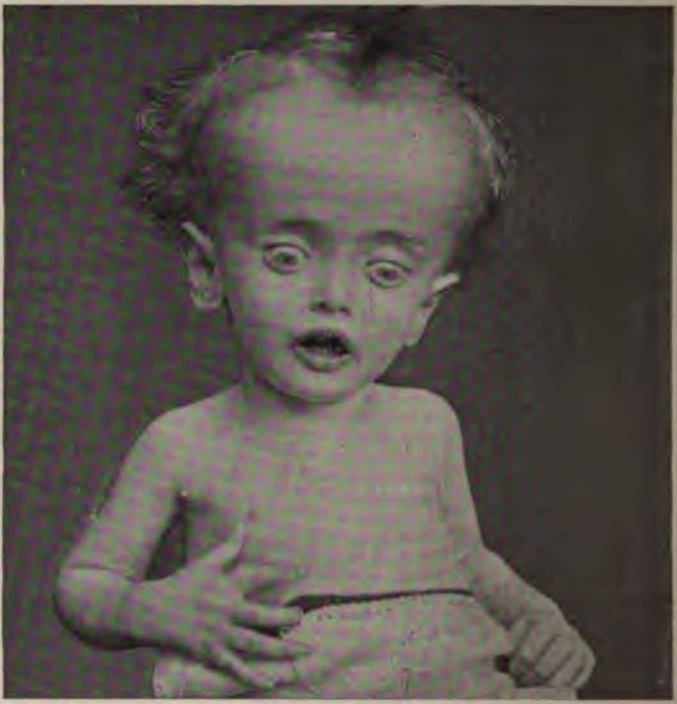

FIG. 119.—Chronic hydrocephalus of average severity; head of pyramidal shape; showing characteristic expression of the eyes.

with the ventricles. The origin of this condition is for the most part unknown. In rare cases the paralysis is due to cortical agenesis,[*] a condition in which the brain may seem normal to the naked eye, but the microscope shows a complete arrest in the development of the cells of the cortex, usually affecting both hemispheres. In still other cases there are found gross defects in development in the motor centres of the cortex. Such a lesion is shown in Fig. 124, page 751. Cases in which there is conclusive evidence of intra-uterine hæmorrhage are very rare.

Symptoms.—In most of the paralyses due to intra-uterine lesions, loss of power is only one of the symptoms, and usually not the most prominent. It is rare that there is not some mental impairment, and usually idiocy is present. The type of paralysis is nearly always diplegic or paraplegic. Where this is due to arrested cortical development, a general flaccidity of the muscles may be seen instead of the rigidity so characteristic of the other forms of cerebral paralysis.

II. **Birth-Paralysis.**—Cerebral birth-paralysis is due in nearly all cases to meningeal hæmorrhage. The primary lesions and the early symptoms have already been described (page 105) in connection with the Diseases of the Newly Born. The secondary lesions present considerable variety. There may be found (1) meningo-encephalitis, (2) atrophy and sclerosis of the cortex, (3) cysts upon the surface, (4) secondary degenerations in the spinal cord.

1. Meningo-encephalitis.—This lesion is often quite diffuse. There is thickening of the pia mater, and it is usually adherent to the brain substance. The cortex is involved to a variable degree, depending somewhat upon the time which elapses between the initial lesion and the autopsy. The following were the microscopical changes found by Sachs[†] in the brain of a child in my wards at the Babies' Hospital, who died at the age of one year of measles: The lesions were found everywhere in the cortex. The pia was universally adherent, and showed general cellular infiltration; its blood-vessels showed marked cellular proliferation, and the veins in the sub-pial space were dilated and filled with blood. In the pia dipping in between the convolutions similar changes were present. In the cortex few if any normal pyramidal cells were found, but in the outer layers were an enormous number of small glia cells. Many of the blood-vessels showed a cell-proliferation of their walls. There was also

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[*] For fuller description, see Sachs's Nervous Diseases of Children, 1895, p. 601.

[†] The clinical features of this case are quite as interesting as the pathological findings. The child was a first-born, delivered after a dry labour of forty-eight hours. It was asphyxiated, and from the first days of its life it had attacks of convulsions, usually repeated many times a day. During one of these convulsions the photograph from which Fig. 122 was made, was taken by Dr. Peterson. The child had the symptoms of typical spastic paraplegia—the arms being, however, slightly involved—retarded mental development, and convergent strabismus.

parison with the normal size. The rapidity of growth is quite as important for diagnosis as the fact of enlargement. If the head grows more than an inch a month there can be little doubt. Hydrocephalus without enlargement of the head can not be diagnosticated. The enlargement most frequently confounded with hydrocephalus is that which occurs in rickets. In the latter disease it is almost invariably irregular; there are prominences over the two frontal eminences and over the parietal bones, often with furrows between them; the size of the head is chiefly due to thickening of the bones of the skull; the marked prominence of the forehead is not seen, and the increase in bi-parietal diameter is not present; furthermore, there are other signs of rickets.

Treatment.—Almost every sort of local treatment has been adopted for hydrocephalus, including incision, aspiration, cranial puncture with the trocar, lumbar puncture, blisters, strapping, and counter-irritation. Up to the present time there does not exist sufficient evidence to show that any one of these means is curative. If aspiration is done, the fluid reaccumulates very quickly, while incision or cranial puncture is almost certain to be followed by meningitis. If there is any reasonable suspicion of syphilis, mercurial inunctions to the head should be employed, and even in other cases a few favourable results have been reported. Convulsions and other functional symptoms are to be treated upon general principles, as they arise. At the present time I believe it is better to refrain from all operative measures unless rupture seems likely to occur.

INFANTILE CEREBRAL PARALYSIS.

Synonyms: Spastic diplegia, paraplegia, or hemiplegia.

Under the term cerebral paralysis are included several groups of cases with causes quite dissimilar, but having certain definite clinical features in common. While the symptomatology is quite clear, there are many questions relating to the pathology that are not yet fully settled, although much has been added to our knowledge within the last few years. Paralysis depending upon cerebral tumour, abscess, or hydrocephalus is not included in this chapter.

The cases of cerebral paralysis may be divided into three groups, according as the paralysis depends upon conditions existing prior to birth, upon those connected with birth, or upon those of subsequent development.

I. **Paralysis of Intra-Uterine Origin.**—This is the least frequent condition. In such cases there is some congenital defect in the brain, due sometimes to arrested development, at others to such intra-uterine lesions as hæmorrhage or thrombosis. There may be porencephalus, or cysts extending deeply into the substance of the brain, sometimes communicating relative frequency of the different forms will vary according to the age at which the patients come under observation. Thus in the statistics of Sachs and Peterson,* there were twenty-seven cases of diplegia or paraplegia, and twenty-two of hemiplegia. These cases were drawn from miscellaneous sources, chiefly from a general neurological clinic. According to my own observations, which have been chiefly upon infants, the cases of diplegia and paraplegia have outnumbered those of hemiplegia more than four to one. My belief is that the great majority of the congenital cases, or those due to hæmorrhage occurring at birth, are diplegias or paraplegias, and that very many of them succumb during the first two years, and never come under the observation of the neurologist; however, the cases of hemiplegia, because of the less serious lesion, live much longer, and hence are more likely to be seen by the specialist. Diplegia

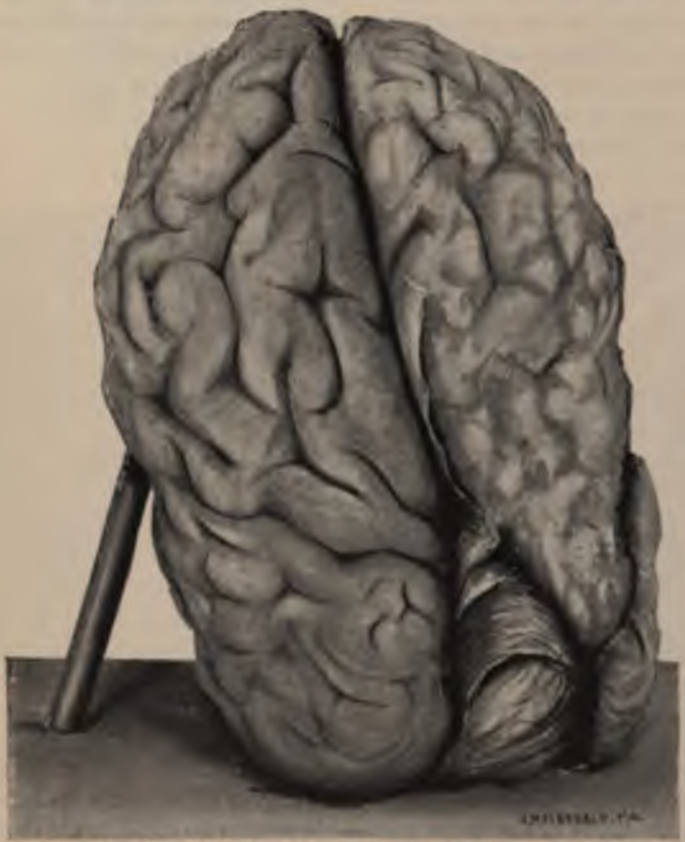

FIG. 121.—Atrophy of right hemisphere; same case as Fig. 120; superior view.

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* Journal of Nervous and Mental Disease, May, 1890.

a degeneration in the pyramidal tracts of the anterior columns of the cord.

2. Atrophy and sclerosis.—These changes vary much in extent and degree. There may be only a circumscribed area in which the convolutions are small, firmer than usual, and covered with an adherent pia, or there may be an atrophy so extensive as to involve a large part of one hemisphere (Figs. 120 and 121), or sometimes of both hemispheres. Usually the lesion is somewhat diffuse over the convexity of both sides, and much more frequently of the anterior than of the posterior half of the brain.

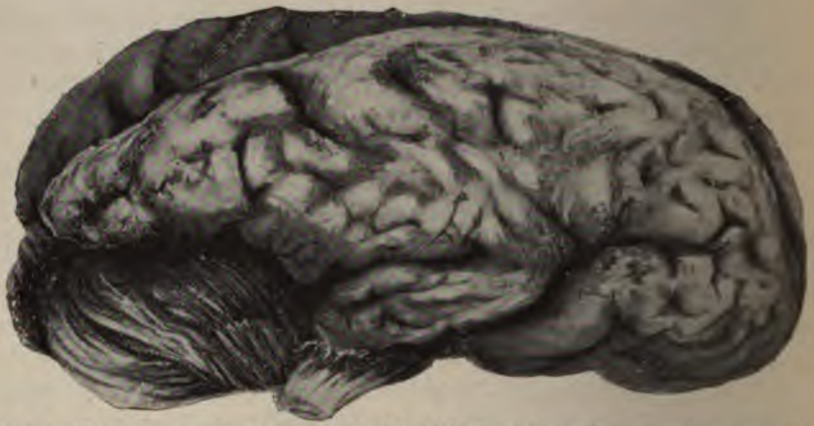

FIG. 120.—Extensive atrophy and sclerosis of the right hemisphere, from an infant seven and a half months old; probably the result of a meningeal hæmorrhage at birth (lateral view).

History.—Twelve hours after birth was seized with general convulsions, which continued for three days. No other symptoms noticed till one month before death, when weakness of left arm was observed. Never held head erect. Was plump and well nourished; died from erysipelas.

Autopsy.—Pia not adherent; a large cyst occupied the region of the occipital and posterior part of the parietal lobes, showing in its floor discolouration and pigmentation, evidently from an old hæmorrhage. Right optic nerve, tract, and crus much smaller than the left.

Where a depression of the brain exists the space is filled with cerebrospinal fluid, and in many cases there is a deformity of the skull.

3. Cysts upon the surface may occur alone or in connection with the lesions just mentioned. These are usually small, about the size of a walnut, but they may cover a large part of a hemisphere. Such large cysts are sometimes classed as cases of external hydrocephalus.

4. Secondary degenerations of the internal capsule and the lateral columns of the cord are found in most of the cases associated with extensive atrophy and sclerosis, and in many of those in which only meningoencephalitis is present.

Symptoms.—The type of paralysis will of course depend upon the extent and position of the original lesion. A diffuse lesion is followed by diplegia; one not quite so extensive by paraplegia; one affecting one side only by hemiplegia, or even monoplegia, though this is very rare. The all pungent were taken only with the greatest difficulty. In some of the worst cases walking is impossible, owing to the shortened tendons and the contractures which have occurred in the muscles. The arms are in nearly all cases much less affected than the legs, and in about half the number, according to the observations of Sachs, they are not involved at all. The condition is not incompatible with long life.

In the mild cases it not infrequently happens that the early symptoms are so slight as to be overlooked, and nothing excites suspicion until the infant is six or eight months old. There is then discovered an unmistakable muscular weakness, as the child can not sit up, or even hold up the head when the trunk is supported. In most of the cases there is observed before this time a tendency to stiffen the body and to throw it backward, owing to spasm of the cervical or spinal muscles. This may be slight, or it may be very marked. The muscular weakness is not infrequently mistaken for rickets, and is sometimes regarded as simple backwardness. A closer examination usually discloses the presence of some rigidity of the extremities, particularly of the legs, and exaggeration of the knee-jerk. As the child grows older the other symptoms of late or imperfect development become more and more evident.

There are changes in the shape of the skull, this being usually smaller than normal in all its diameters, or there may be asymmetry. There is an arrest of development in the paralyzed limbs. These are both smaller and shorter than normal. There is marked muscular atrophy. In many cases abnormal movements are seen, which may be of an irregular choreic type, or they may be athetoid. According to various statistics, epilepsy develops in from 33 to 50 per cent of all the patients affected.

III. **Acute Acquired Paralysis.**—This is usually of the hemiplegic type, although diplegia and paraplegia may in rare instances be met with. This group includes cases developing at any time after birth, but the great majority of those seen in childhood, begin before the fifth year.

Etiology.—The etiology of many of these cases is very obscure. The paralysis sometimes follows traumatism. It is occasionally seen in the course of scarlet fever, measles, diphtheria, variola, and pneumonia. Much more frequently than with any of these diseases it occurs during pertussis, being usually the outcome of a severe paroxysm. Aside from the traumatic cases and those occurring with pertussis (and these include but a small proportion), the real cause is for the most part unknown. The frequency with which these cases are ushered in with convulsions has led many to assign this as the cause of the paralysis. It is more probable that the convulsions are the result than the cause of the lesion producing the paralysis.

Lesions.—The lesions of acute cerebral palsy may be grouped under three heads: (1) those of the blood-vessels; (2) those of the membranes; (3) those of the brain substance.

and paraplegia will therefore be considered as the characteristic types of cerebral birth-palsy, as the cases of hemiplegia do not differ from those due to later causes—i. e., the acquired form.

In the most severe cases that survive the symptoms of the early days of life (page 107) there remains some rigidity of the extremities, chiefly of the legs, which is constant or intermittent, slight or well marked. There is often spasm of the muscles of the neck and trunk, giving rise to opisthotonus. In many cases there are frequent attacks of convulsions (Fig. 122). The general physical development of the child is often interfered with, so that it remains small and delicate, and perhaps dies of some acute disease in early infancy, never having been able to sit erect, or even support its head. In other cases the general nutrition is not affected, and the infants may be plump and well nourished. Such children may live indefinitely. There is always some degree of mental impairment; it may be so slight as not to be noticeable until the child is old enough to talk, and sometimes not until the age of four or five years; or the child may be idiotic. Speech is not only delayed, but is very imperfect. Hearing is frequently affected, but sight rarely. Often these children are not able to walk alone until they are four or five years old, and then with a peculiar cross-legged gait, owing to spasm of the adductors of the thighs. This may be so great as to entirely prevent walking, and while sitting or lying the thighs may cross each other. All the reflexes are greatly exaggerated. In one child under my observation the pharyngeal reflex was so much increased that swallowing of solid food was impossible, owing to spasm of the muscles. Alcoholic stimulants and medicines that were at

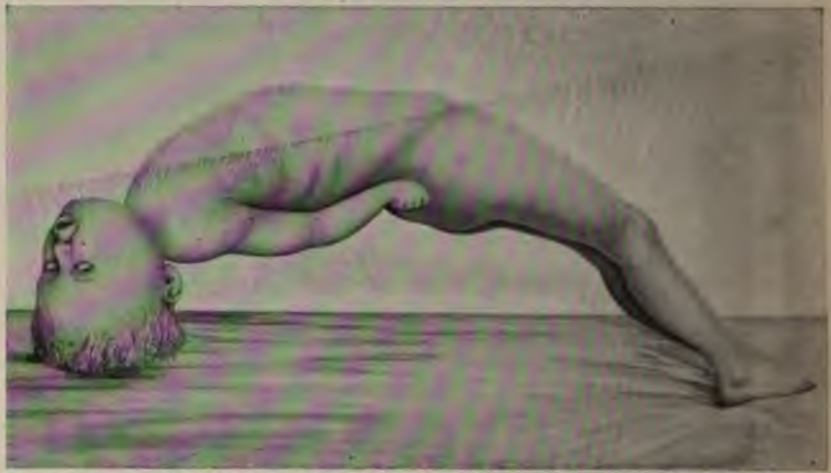

FIG. 122.—Convulsions in spastic paraplegia; from a photograph by Dr. Frederick Peterson during an attack. (History on page 743.)

all pungent were taken only with the greatest difficulty. In some of the worst cases walking is impossible, owing to the shortened tendons and the contractures which have occurred in the muscles. The arms are in nearly all cases much less affected than the legs, and in about half the number, according to the observations of Sachs, they are not involved at all. The condition is not incompatible with long life.

In the mild cases it not infrequently happens that the early symptoms are so slight as to be overlooked, and nothing excites suspicion until the infant is six or eight months old. There is then discovered an unmistakable muscular weakness, as the child can not sit up, or even hold up the head when the trunk is supported. In most of the cases there is observed before this time a tendency to stiffen the body and to throw it backward, owing to spasm of the cervical or spinal muscles. This may be slight, or it may be very marked. The muscular weakness is not infrequently mistaken for rickets, and is sometimes regarded as simple backwardness. A closer examination usually discloses the presence of some rigidity of the extremities, particularly of the legs, and exaggeration of the knee-jerk. As the child grows older the other symptoms of late or imperfect development become more and more evident.

There are changes in the shape of the skull, this being usually smaller than normal in all its diameters, or there may be asymmetry. There is an arrest of development in the paralyzed limbs. These are both smaller and shorter than normal. There is marked muscular atrophy. In many cases abnormal movements are seen, which may be of an irregular choreic type, or they may be athetoid. According to various statistics, epilepsy develops in from 33 to 50 per cent of all the patients affected.

III. **Acute Acquired Paralysis.**—This is usually of the hemiplegic type, although diplegia and paraplegia may in rare instances be met with. This group includes cases developing at any time after birth, but the great majority of those seen in childhood, begin before the fifth year.

Etiology.—The etiology of many of these cases is very obscure. The paralysis sometimes follows traumatism. It is occasionally seen in the course of scarlet fever, measles, diphtheria, variola, and pneumonia. Much more frequently than with any of these diseases it occurs during pertussis, being usually the outcome of a severe paroxysm. Aside from the traumatic cases and those occurring with pertussis (and these include but a small proportion), the real cause is for the most part unknown. The frequency with which these cases are ushered in with convulsions has led many to assign this as the cause of the paralysis. It is more probable that the convulsions are the result than the cause of the lesion producing the paralysis.

Lesions.—The lesions of acute cerebral palsy may be grouped under three heads: (1) those of the blood-vessels; (2) those of the membranes; (3) those of the brain substance.

1. Lesions of the blood-vessels.—There may be either hæmorrhage, embolism, or thrombosis. Hæmorrhage is by far the most important. It is usually meningeal, very rarely cerebral. It occurs more frequently at the convexity than at the base, and is often quite diffuse. Meningeal hæmorrhage may result from pachymeningitis. I have elsewhere stated my conviction that this is more frequent than is generally supposed. It may be due to traumatism, where it is also from the dura mater; or from the acute hyperæmia accompanying paroxysms of pertussis, where it may be from the dura or the pia; or it may be secondary to thrombosis of the superior longitudinal sinus. The association of hæmorrhage with sinus-thrombosis is not very infrequent. It was found in one of my autopsies upon a patient who died of pneumonia. The bleeding in these cases is usually from the pia. Cerebral hæmorrhage is extremely rare, but it occurs even in infants; I once saw it in one only two months old.

Embolism is rarely found unless associated with acute rheumatic endocarditis, and then usually in children who are over seven years old. As in adults, the usual seat of the embolus is a branch of the middle cerebral artery. It may be single or multiple. Thrombosis has been met with in a small number of cases, but it is extremely rare.

2. Lesions of the membranes.—These are generally the result of old cerebro-spinal meningitis; sometimes they may be of syphilitic origin. In both, however, the process is rarely confined to the membranes; it is a meningo-encephalitis.

3. Lesions of the brain substance.—Atrophy and sclerosis are terminal conditions found in a large number of the autopsies made upon cases where the paralysis has been of long standing. They vary in severity and extent, and are followed by secondary degeneration in the cord, as in cases of birth paralysis. There may be the same development of cysts of the pia mater, or an accumulation of fluid in the arachnoid cavity, these taking the place of the atrophied convolutions. What the primary lesion is in these cases is still a matter of debate. Strümpell believes many of them to be due to an acute poliencephalitis, analogous to acute poliomyelitis. Cases are not infrequently seen clinically, which this pathology seems to explain very satisfactorily. However, there is as yet lacking sufficient anatomical evidence to establish this view.

In this connection may be mentioned a case of acute paralysis in which no lesion was found. In the spring of 1894, there was admitted to my service in the Babies' Hospital, an infant with pneumonia, who had developed, a few days before, typical right hemiplegia. The pneumonia antedated the paralysis by several days. The latter came on suddenly, with convulsions, and involved the face, arm, and leg. The arm and leg appeared to be completely paralyzed, but in the face the paralysis was incomplete. The paralysis had begun to improve somewhat at the time of the child's death, which occurred a little over a week after its onset.

At the autopsy no gross lesion could be discovered. A careful microscopical examination was made by two expert pathologists, Drs. C. A. Herter and J. S. Thacher, who could find no explanation of the paralysis. Nothing abnormal was found except "a slight increase of small spheroidal cells about some of the meningeal and cortical vessels of the motor area. The frontal and occipital lobes were normal."

Symptoms.—While diplegia and paraplegia are occasionally seen, the great majority of cases of acquired cerebral palsy are of the hemiplegic variety. When diplegia and paraplegia occur, it is usually in early infancy, and their symptoms and course differ in no wise from the birth palsies. We may therefore regard hemiplegia as the chief manifestation of acquired cerebral palsy.

The onset of the paralysis is almost invariably sudden, with convulsions, which are usually repeated, and in severe cases followed by loss of consciousness. In the secondary cases these are generally the only symptoms. In one of my cases the patient went to bed apparently well, and awoke in the morning with hemiplegia. Such an onset, however, is very exceptional. When the paralysis is apparently primary, fever is usually present, and in addition to the convulsions there may be vomiting, delirium, and other symptoms, strongly suggestive of an acute inflammatory process in the brain, which continue for a variable time, usually two or three days, before paralysis is seen. The temperature in most cases is from 100° to 102° F., and the rise of temperature follows more frequently than precedes the convulsions. After the child recovers consciousness, and sometimes before this, the paralysis is discovered. If there is a very extensive lesion there may be diplegia, deep coma, and death, but this is very infrequent. Usually the lesion is more limited, and the symptoms are those of typical hemiplegia. It is rare that the face is much involved, and often it escapes altogether. The paralysis of the arm and leg is at first complete, but may improve very rapidly in the course of a few days. Disturbances of sensation are usually of a transient character. After a variable period, from one to several weeks, the patient begins to use the paralyzed extremities, the arm recovering more slowly than the leg, as in adult hemiplegia. The convulsions may be repeated for the first day or two, but prolonged or continuous convulsions are rare. With lesions of the left side of the brain, speech may be affected, and not infrequently in young children when the lesion is upon the right side. The reflexes are increased upon the affected side, and slight ankle-clonus may be present.

In the course of a few weeks the child may be able to walk, dragging the affected leg; the recovery in the leg is sometimes complete, but in most cases a slight halt in the gait remains. The arm usually recovers more slowly than the leg, and contractures are likely to develop after a variable time, generally two or three years. In Fig. 123 is shown a frequent deformity of the upper extremity. Contractures of the leg lead to various forms of talipes, generally equinus, from shortening of the tendo-Achillis. Sometimes the arm or the leg recovers so perfectly that the case may be regarded as one of monoplegia. In old cases the paralyzed limbs are atrophied; there is more or less rigidity, and the spastic condition may be quite marked. I have seen this limited to a single group of muscles in the leg. Aphasia is common in right hemiplegias, and it is not very rare in those of the left side, because infants appear to use both sides of the brain with nearly equal facility.

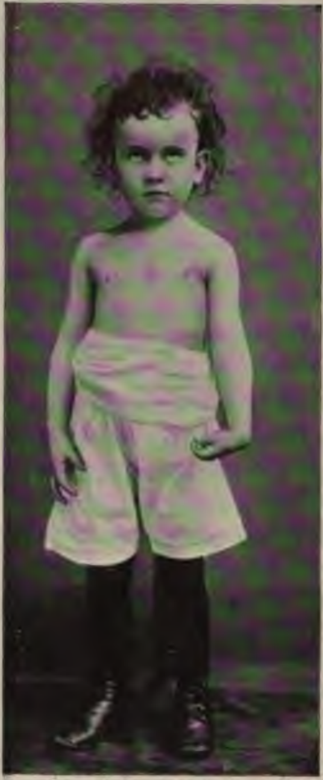

FIG. 123.—Deformity of left hand the result of contractures following an attack of hemiplegia four years before; child seven years old.

The mental condition of these children is usually normal, in striking contrast with the cases of congenital diplegia. The earlier the paralysis occurs the more likely are mental symptoms to be present, since we have here not only the direct effect of the lesion, but an arrested development of some part of the brain. Epilepsy is not an uncommon sequel; it may be of the Jacksonian type, or there may be attacks of general convulsions. In other cases there are post-hemiplegic movements of a choreic or athetoid character, or irregular inco-ordinate movements.

Prognosis of Infantile Cerebral Paralysis.—In diplegia and paraplegia the outlook is always unfavourable. A very large number of these cases which are due either to intra-uterine or birth lesions, never reach the third year, but die in infancy of marasmus or acute intercurrent disease. Those who survive usually show serious mental defects, and many are practically helpless on account of the extreme spastic condition of the muscles of the extremities.

In hemiplegia the prognosis is much more favourable. In most of these cases the paralysis is of the acute acquired variety, and the later the period of onset, the less likely is the brain to be seriously damaged. In some of these patients complete recovery takes place; in others the residual paralysis is so slight as to be easily overlooked except on careful examination, the occurrence of epilepsy being perhaps the first thing which leads one to suspect that a previous paralysis has existed. The great majority of children who have suffered from infantile cerebral palsy have some degree of permanent paralysis and usually some deformities from contractures, the extent of both varying, of course, with the severity of the primary lesion. In all cases seen in young infants it is exceedingly difficult to give a prognosis in regard to future mental development. As a rule, the impairment is directly proportionate to the extent of the paralysis and its intensity; although in exceptional cases we find a good deal of mental disturbance with only moderate paralysis, and *vice versa*.

Diagnosis.—The diagnosis between the congenital and acquired forms of cerebral palsy is of no great practical importance, and it may be impossible; for the symptoms in congenital cases are often not sufficiently marked to attract attention until children are old enough to sit alone or to walk.

It may be quite difficult to distinguish cerebral paralysis from infantile spinal paralysis. The history of an acute onset, the atrophied limbs, the deformities, and the absence of sensory disturbances, may be found in both conditions. Spinal paralysis is, as a rule, monoplegic, and often affects but a single group of muscles. Cerebral paralysis is either diplegic or hemiplegic in character, and even though only a leg or an arm may seem to be affected, a critical examination will usually reveal the fact that the other limb of that side has also suffered. The presence of rigidity and exaggerated reflexes is quite as important evidence of this as loss of power. The electrical reactions, however, are conclusive; the reaction of degeneration is absent in cerebral paralysis, while it is present in spinal paralysis.

Simple as the differentiation may seem in most cases, the mistake is frequently made of confounding cerebral diplegia, particularly of the flaccid type, with rickets. But a careful history and a thorough examination will usually dispel all doubt (see pages 232, 233). Cases of acute acquired paralysis at the onset may be mistaken for acute meningitis, but early loss of consciousness, the early development of the paralysis, its permanent character, and the short duration of the acute symptoms, distinguish cases of hæmorrhage from those of meningitis; but when it follows traumatism, and when it occurs in the course of some other disease such as pneumonia or scarlet fever, it may be difficult or impossible to make a diagnosis between the two conditions.

Treatment.—The course and the result of cerebral paralysis depend upon the extent of the injury to the brain, its nature, and the age at which it is inflicted,—all these being conditions which are beyond the power of the physician to modify or control. The treatment of cerebral palsy is therefore extremely unsatisfactory. For the congenital cases practically nothing can be done, except for the deformities and complications. The acquired cases during the acute onset are to be managed like all other cases of acute cerebral congestion or inflammation,—absolute rest, ice to the head, and bromides. Electricity is never to be used in early cases, and little or nothing is to be expected from it in the late ones. Much can be accomplished in an educational way for the mental derangements re-

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5. Those of inflammatory ori
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6. Those associated with epilep
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7. Sporadic cretinism (page 75

Cases of mental impairment p
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In addition to the etiological f
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Most cases of idiocy exhibit to
of degeneration (page 757). In

seventeen idiots by Howe, there were found blindness in twenty-one; deafness in twelve; some defect of the nose or mouth, such as hare-lip, high

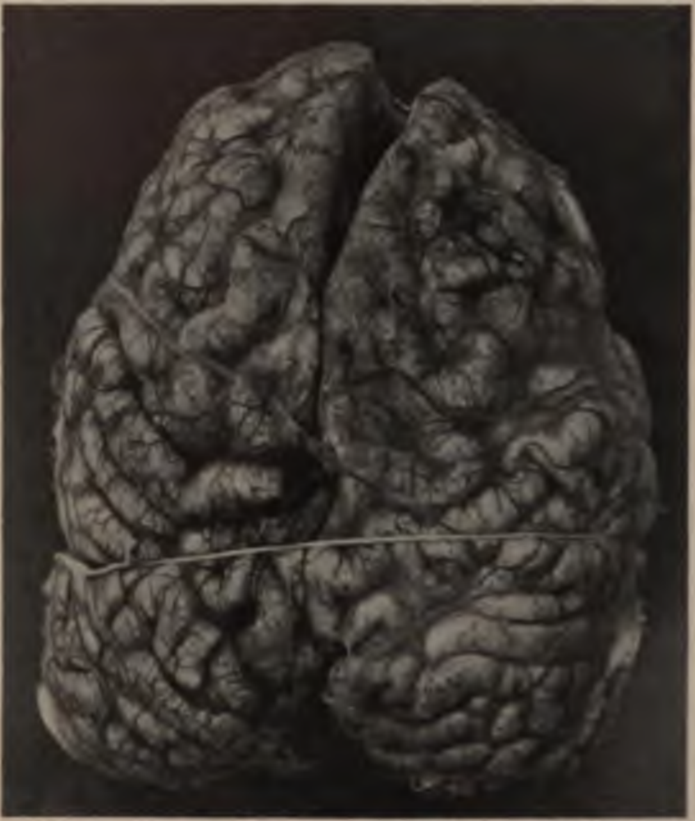

FIG. 124.—Arrested development of the frontal lobes of the brain, particularly of the right side, from an idiotic child twelve months old.[*]

palatal arch, or cleft palate, in twenty-three cases; and some deformity of the hands or feet in fifty-four cases; while in ninety-six there was paralysis of one or more limbs.[†]

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[*] A microscopical examination by Dr. Martha Wollstein showed the cortex in the affected region to be only one-third the normal thickness; the cortical layers were ill-defined; there was a striking absence of the characteristic nerve cells, both the large and small pyramidal cells being few in number. There was no growth of connective tissue. The white substance was normal, as were also the dura and pia.

[†] For the symptoms of idiocy in detail, reference is made to works on diseases of the nervous system, especially to the Monograph of Langdon Down, and to the article by Brush in Keating's Cyclopædia, vol. iv, p. 1019, in which will be found references to recent medical literature upon the subject.

SPORADIC CRETINISM.

Synonyms: Cretinoid Idiocy; Myxœdematous Idiocy; Idiocy with Pachydermatous Cachexia.

Since the early description of this disease by Fagge, in 1871 and 1874, numerous cases have been published in England, on the continent of Europe, and in America, showing that the disease is not confined to any country. During the last six years, five cases have come under my own observation. While the disease is rare, cretins are much more common than was formerly supposed.

Etiology.—It is now well established that this condition depends either upon a congenital absence of the thyroid gland, or something which abolishes its functions. In Bramwell's series of forty-four cases, ten autopsies are reported; in nine of these no trace of the thyroid gland could be found, and in the tenth one lobe was the seat of a large tumour. The symptoms are practically identical with the myxœdema of adults which follows the removal of the thyroid gland. Regarding the causes which destroy the thyroid gland or abolish its functions little is as yet known. In most cases it is a congenital condition. In some instances it has followed acute disease. As a rule, only one case occurs in a family, the other members of which present nothing abnormal in mental or physical development.

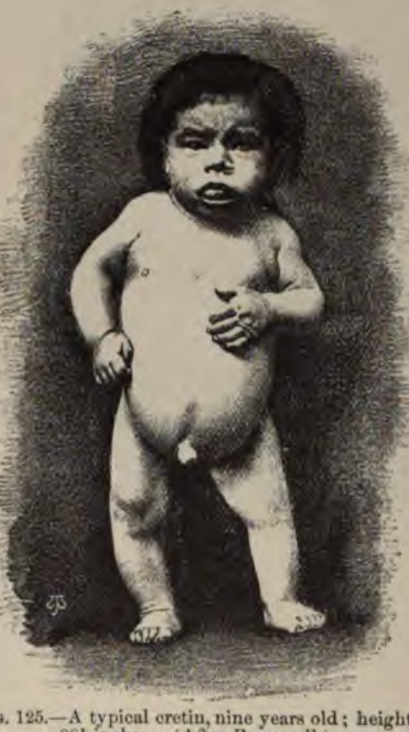

FIG. 125.—A typical cretin, nine years old; height, 28¼ inches. (After Bramwell.)

Symptoms.—The symptoms of cretinism in most cases make their appearance during the first year, sometimes not until children are two or three years old, and occasionally none may be seen until the seventh or eighth year. The general appearance of the cretin is very striking, and so characteristic that when once seen the disease can hardly fail to be recognised (Figs. 125 and 126). The body is greatly dwarfed, and children of fifteen years are often only two and a half or three feet in height. All

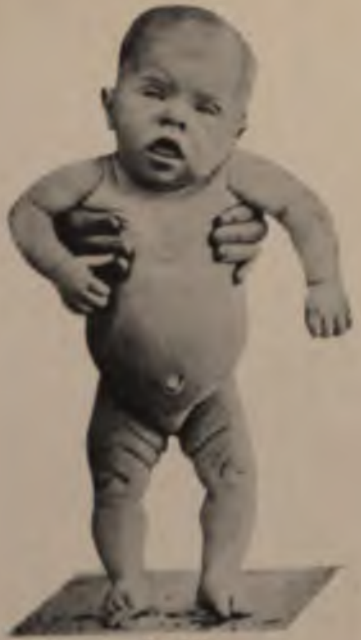

FIG. 126.

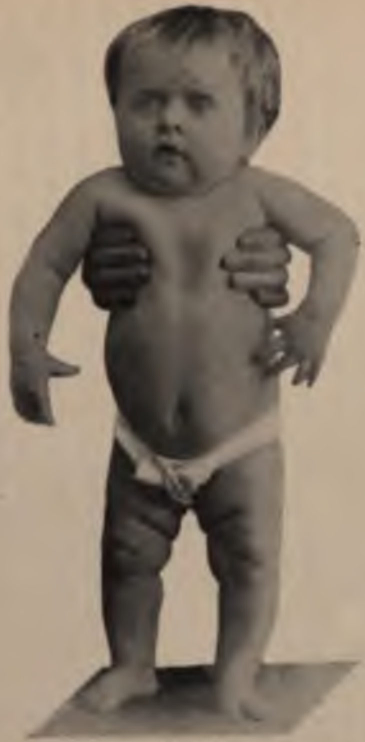

FIG. 127.

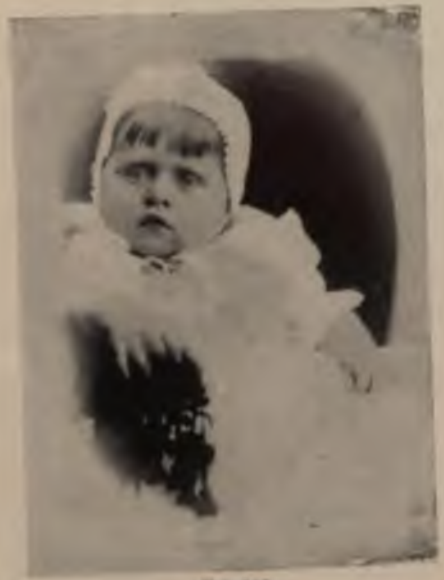

FIG. 128.

Dr. J. P. West's case of cretinism. Fig. 126, at seventeen months before treatment. Fig. 127, after six months' treatment with thyroid extract, having gained in weight 8 pounds, in height 4 inches, in circumference of head 2½ inches. Fig. 128, after one year's treatment.

the extremities, the fingers and the toes, are short and stumpy. The subcutaneous tissue seems very thick and boggy, but does not pit upon pressure like ordinary œdema. The facies is extremely characteristic: The head seems large for the body, the fontanel is open until the eighth or tenth year, and it may not be closed even in adults; the forehead is low and the base of the nose is broad, so that the eyes are wide apart; the lips are thick, the mouth half open, and the tongue usually protrudes slightly; the cheeks are baggy, the hair coarse, straight, and generally light coloured. The teeth appear very late—in one of my cases none were present at two years—and are apt to decay early.

Fatty tumours are quite constant in older children, although they were wanting in two of my infantile cases. They are seen in the supra-clavicular region, just behind the sterno-mastoid muscle, sometimes in the axilla, or between the scapulæ, and sometimes in other parts of the body. In distribution they are apt to be symmetrical, and are usually about the size of a hen's egg. The neck is short and thick. In some cases there is a depression corresponding to the location of the thyroid gland. The chest is not deformed. The abdomen is large, pendulous, and resembles that of rickets. The skin is dry, perspiration scanty, and eczema is common. The voice is hoarse and rough. Patients often do not walk until they are five or six years old, and then they waddle in a clumsy way. All the movements of the body are slow and lethargic, and everything indicates a mental and physical torpor. The rectal temperature is usually subnormal. I had once an opportunity to observe an attack of acute broncho-pneumonia in one of these cretins two years old. The symptoms and physical signs were typical, but during the greater part of the disease the rectal temperature fluctuated between 95° and 98·5° F. Only once was a temperature above 99° F. recorded. On account of their low temperature and torpid condition these patients are very sensitive to cold. The mental condition is always impaired, and they are usually idiotic. Speech is acquired late, and in some cases not at all. Cretins are dull, placid, and good-natured, rarely troublesome or excitable; and when fifteen or eighteen years old they appear like children of two or three years. There is an absence of development of the sexual organs, and almost invariably they suffer from chronic constipation.

Diagnosis.—The diagnosis is usually easy, although the early cases are sometimes miscalled rickets. The low temperature, the facial expression, the torpor, and the fatty tumours are enough to differentiate the two diseases.

Prognosis and Treatment.—There is no tendency to spontaneous improvement. Many of these cases die in childhood, but a few live to adult life. Until within the last few years they have been considered hopeless. The improvement which followed the use of the thyroid extract in cases of adult myxœdema has led to a trial of this remedy in sporadic cretinism. A sufficient number of cases have now been recorded to establish the fact that the thyroid extract is a specific remedy for this disease. Peterson and Bailey[*] have collected forty cases treated in this manner. No case failed to improve when the extract was properly given. In twenty-five cases the improvement was very striking, and in several it was truly remarkable (Figs. 126, 127, 128). After a few months' treatment the entire appearance of the child is in most cases changed: The idiotic expression of the features is lost; the thickening of the skin and subcutaneous tissues disappears; there is a marked increase in weight, and in the growth of the whole body; muscular power is rapidly developed, so that many soon become able to walk; and progress is seen in dentition, and in some older girls in the establishment of menstruation. Intellectual progress is much slower than physical changes; however, nearly all the children become brighter and more intelligent, and a few learn to talk. In none of the cases so far reported has treatment been continued longer than eighteen months, so that it is as yet impossible to say whether improvement will continue indefinitely, and whether complete recovery is to be expected. From present knowledge the latter seems very improbable. In all cases the thyroid extract must be given indefinitely, for otherwise improvement ceases at once, and cases may even relapse. The earlier the treatment is begun the more marked is the improvement usually noticed.

The preparation most used in America is Parke, Davis & Co.'s desiccated extract, prepared from the thyroid gland of the sheep. Of this from one half to one grain is given twice a day. Some disturbances are often seen at the beginning of the treatment—perspiration, fretfulness, and sometimes a rise in temperature—but these soon pass off. In some cases a smaller dose must be used at first, and the increase made very gradually.

INSANITY.

Insanity is so special a subject, that all that will be attempted here will be to mention the most frequent varieties seen in early life, with the important etiological factors which operate at this period. For a full discussion of the subject the reader is referred to works upon insanity, and to Sachs, in whose book[†] will be found quite a full bibliography of this branch of the subject.

Insanity is distinguished from idiocy in that it affects a mind previously sound, however, the two conditions may be associated. Undoubted cases of mental disease have been observed before the seventh year, but

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[*] Pædiatrics, May 1, 1896. See also Osler, American Journal of the Medical Sciences, November, 1893; and Bramwell's Monograph on Cretinism.

[†] Nervous Diseases of Children, New York, 1895. See also Mills, in American Text-Book of Diseases of Children, edited by Starr, Philadelphia, 1894.

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Etiology.—Insanity is someti
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follow measles, scarlet fever, di
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Alcoholism, epilepsy, insanity, or
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in the establishment of menstruati
and throat; these, however, can no
predisposition is a strong one. I
follow hysteria, chorea, or epilepsy.
the brain, acute meningitis, and oc

Symptoms.—Certain forms of
children, such as paranoia or prim
tia, paretic dementia, periodic or ci

Mania is one of the most freq
variety of post-febrile insanity. Its
are usually of short duration, lasti
cases it may continue for months, a

Melancholia is not uncommon.
mental strain in school, it may be d
times may follow masturbation. It
marked disturbance of the general h
by fits of depression, self-mutilation,

Epileptic insanity may follow epi
mentally sound, where it may take
or there may be attacks of mania wh
seizure or follow such a seizure.
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of epilepsy.

Other forms which insanity assu
choses, such as delirium, night-terr
sometimes from fright; moral insan
moral sense from injury or disease,
morbid impulses, which may be hom
thieving, lying, pyromania, etc.; mor

almost endless variety. These are sometimes associated with a low state of physical health; this, however, is usually not the case.

Prognosis.—On the whole, insanity in childhood has a better prognosis than in the adult. In most of the cases of mania, melancholia, the various transitory psychoses, or the choreic and hysterical forms, recovery occurs with proper treatment. The outlook for the other varieties is much worse, especially in those in which there is a strong hereditary tendency to mental disease.

The treatment is to be conducted along the same general lines as in adults.

THE STIGMATA OF DEGENERATION.

These marks are of much importance in relation to the different forms of nervous disease in children, especially epilepsy, idiocy, and insanity. They are of great value in determining existing nervous disease, or as showing latent neuropathic tendencies.

The physician should be familiar with these various signs in order that he may connect them with each other and refer them to their proper source, and at the same time, by appreciating their significance, be able to advise parents with regard to the care, education, mode of life, and occupation of children, in whom to a greater or less degree these signs may be present. These stigmata are not of equal importance as marks of degeneration. Some of them, such as facial asymmetry and most of the deformities of the palate, are always to be so regarded; the speech defects are often so, while many of the others may or may not be, according to their association. The stigmata are divided into anatomical, physiological, and psychical. The following is the classification given by Peterson:*

Anatomical Stigmata.—Cranial anomalies: Facial asymmetry; deformities of the palate; anomalies of the teeth, tongue, lips, or nose.

Anomalies of the eye: Flecks on the iris; strabismus; chromatic asymmetry of the iris; narrow palpebral fissure; albinism; congenital cataract; pigmentary retinitis.

Anomalies of the ear.

Anomalies of the limbs: Polydactyly; syndactyly; ectrodactyly; symelus; phocomelus; excessive length of the arms.

Anomalies of the trunk: Herniæ; malformation of the breasts and thorax; dwarfishness; giantism; infantilism; margininism; masculinism; spina bifida.

Anomalies of the genital organs.

Anomalies of the skin: Polysarcia; hypertrichosis; absence of hair; premature grayness.

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* Deformities of the Hard Palate in Degenerates, by Frederick Peterson, M. D., International Dental Journal, December, 1895.

Physiological Stigmata.—Anomalies of motor function: Walking late; tics; tremors; nystagmus; epilepsy.

Anomalies of sensory function: Deaf-mutism; neuralgia; migraine; hyperæsthesia; anæsthesia; blindness; myopia; hypermetropia; astigmatism; Daltonism; hemeralopia; concentric limitation of the visual field.

Anomalies of speech: Mutism; defective speech; stuttering; stammering.

Anomalies of genito-urinary function: Enuresis; sexual irritability; impotence; sterility.

Anomalies of the instinct or appetite: Merycism; uncontrollable appetites for food, liquor, drugs, etc.

Diminished resistance to external influences and diseases.

Retardation of puberty.

Psychical Stigmata.—Insanity; idiocy; imbecility; feeble-mindedness; eccentricity; moral delinquency; sexual perversion.

DEAF-MUTISM.

Excluding the cases in which idiocy is present, which are not considered in this chapter, deaf-mutism may be due either to congenital or acquired conditions; the larger proportion of the cases belong in the latter class. When congenital, deaf-mutism may result from ostitis, or periostitis of the temporal bone, encroaching upon the cavity of the middle ear, from anchylosis of the ossicles, from absence of the internal ear or any of its parts. There may also be colloid degeneration of the labyrinth. It may result from atrophy of the auditory nerve, and it may be due to a lesion of the brain. These congenital conditions are often hereditary. Acquired deaf-mutism is most frequently the result of scarlet fever, and is due to otitis. The second important cause is cerebro-spinal meningitis, where it may be due to a lesion of the brain, the auditory nerve, or the ear. It occasionally follows mumps, diphtheria, measles, and other infectious diseases. It may result from repeated attacks of acute otitis associated with adenoid growths or chronic rhino-pharyngitis.

The younger the child at the time the deafness occurs the sooner the power of speech is lost. In most of the infectious diseases, if the attack occurs before the fifth year speech is lost. According to Love,* total deafness is rare among deaf-mutes; hearing for speech is present to a useful degree in about twenty-five per cent of the cases, while hearing by cranial conduction exists in nearly all cases. Deaf-mutism should be suspected if a child not idiotic shows at the end of two years no signs of beginning to talk. A careful distinction should be made between deaf-mutism and idiocy resulting either from congenital conditions or acquired disease.

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* Deaf-Mutism, by James K. Love. Macmillan & Co., 1896.

It is necessary that this condition be recognised as early as possible, in order that the child may have the advantages of proper training during its early years. The physician should insist upon the child being sent to an institution where it may be taught to speak as early as the third, and certainly by the fourth year.

The treatment is mainly prophylactic. The most important relates to the care of the ears in scarlet fever, and the removal of adenoid vegetations of the pharynx and other causes which produce attacks of acute or chronic otitis. For the condition itself education is the only thing to be considered.

CHAPTER IV.

DISEASES OF THE SPINAL CORD.

MALFORMATIONS.

MALFORMATIONS of the cord are very frequently associated with those of the brain, and bear a certain degree of resemblance to them. (1) The cord may be absent (amyelia); this condition may exist alone or with absence of the brain. (2) The lack of development may be only partial (atelomyelia), as where some of the tracts are wanting. The most important one is defective development of the lateral tracts, which may be a cause of spastic paraplegia (Charcot). (3) There may be a malposition of some of the gray matter (heterotopia). (4) There may be a double cord (diplomyelia); the division is generally incomplete, and is attributed to an abnormal development of the central canal; it is usually associated with other deformities. All of these malformations are extremely rare and of very little practical interest.

There remains to be mentioned the only one which is really important—spina bifida.

Spina Bifida.—This is a malformation of the vertebral canal with a protrusion of some part of its contents in the form of a fluid tumour. The tumour is elastic, compressible, usually increased by crying, and sometimes by pressure upon the anterior fontanel. The contained fluid is clear serum, resembling in all respects the cerebro-spinal fluid. It is one of the most frequent congenital deformities.

According to Humphrey, spina bifida is due to an early failure in development,—in most cases before the cord is segmentated from the epiblastic layer from which it is developed. Hence it remains adherent to the epiblastic covering, and the structures which should be formed between the cord and the skin are undeveloped. For this reason we have in the wall of the sac a fusion of the elements of the cord, nerves, meninges, vertebral arches, muscles, and integument. If the error in development occurs

later, the cord and nerves may
fused with it; in still other case
The malformation may occur be
is closed; or, if closed, it may re
mulation of fluid. It is probab
tion of fluid first occurs, and th
union of the parts of the vertebra

Although the tumour is gener
bifid spine, this is not necessarily
trusion may take place through
notch or foramen, or there may
bodies of the vertebræ, and an ant
ing into the cavity of the thorax, a
spina bifida occulta. The princip
ties are meningocele, meningo-mye
myelocele.*

Meningocele.—In this form th
of the membranes only (Fig. 129).
of fluid is either in the arachnoid c
rior to the cord. The opening of c
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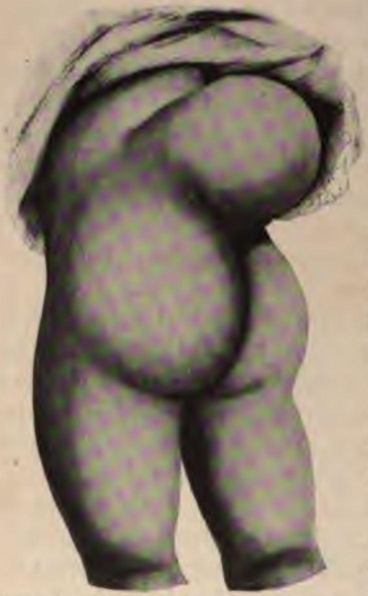

FIG. 130.—Meningocele, in a child one year old.

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* See Report of London Clinical Society
1885.

The accumulation of fluid takes place in the anterior subarachnoid space, less frequently in the anterior arachnoid cavity (Fig. 131). In this form the cord is contained in the sac, and usually forms a part of its wall. The tumour is smaller than the meningocele, the usual size being that of a mandarin orange. It is sessile, never pedunculated. As a rule it is only partly covered by skin, but has a central area, elliptical in shape, where there is only a thin, translucent membrane. This surface, which is known as the central cicatrix, is sometimes covered with granulations, and frequently ulcerates. The tumour often has a vertical furrow or a central umbilication, corresponding to the attachment of the cord on its inner surface. The usual relation of the parts is for the cord to run horizontally across the upper part of the tumour to the central cicatrix, with which it becomes blended, and from which again the nerves arise. These re-enter the canal at the lower part of the tumour, and are distributed below as usual. In other cases the cord joins the wall of the sac soon after its entrance, and its attenuated fibres are found spread out all over the sac, coming together again below and entering the spinal canal.

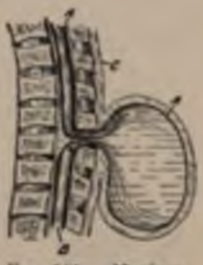

FIG. 131.—Meningo-myelocele (partially diagrammatic). *A*, the membranes; *B*, the cord; *C*, the integument. The accumulation of fluid is in front of the cord, the filaments of which are spread out, forming a part of the wall of the sac.

The following case, upon which I recently made an autopsy, is a good example of the common variety: The child died on the third day after birth from rupture of the sac. The tumour occupied the sacral region. The first sacral vertebra was normal, and beneath this the cord passed, terminating in the cauda equina soon after entering the sac, and continued back to the central cicatrix. Here nerve filaments blended with the other tissues in an indefinite structure, from which again, with tolerable distinctness, they could be seen to pass over the wall of the sac and return to the canal. The afferent and efferent nerves and the part of the membranes they carried with them formed several septa, making a smaller separate sac within the larger one. The large sac was clearly a dilatation of the anterior subarachnoid space, and communicated freely with the same space in the cord above.

Syringo-myelocele.—In this variety the accumulation of fluid is in the central canal of the cord, the lining of the sac being here the attenuated and atrophied cord elements. This is the rarest form of tumour, but the one most frequently associated with hydrocephalus, and consequently having the worst prognosis. It is usually found in the dorsal or dorso-lumbar region, rarely in the lumbo-sacral (Fig. 132).

With spina bifida other deformities are frequently associated, the most common being club-foot, hydrocephalus, more rarely encephalocele or cerebral meningocele, and hare-lip. If hydrocephalus exists, there is in

most cases a dilatation of the cer
munication between the tumour

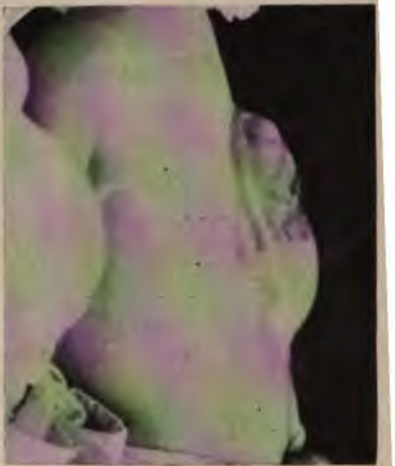

FIG. 132.—Syringo-myelocele of the mid-dorsal region, in a child four months old, who also had hydrocephalus.

cal tumours, and most marked in
gion. In the worst cases there is
the bladder and rectum. If the tu
mour is sacro-lumbar or sacral, onl
the cauda equina is likely to be in
volved, and this but partially, s
that the paralysis of the extremitie
is incomplete, and the bladder an
rectum may escape.

In Fig. 133 is shown a very re
markable case of sacral spina bifid
in a boy of five years, who cam
under observation for incontinenc
of fæces. The tumour was a littl
more to the left than to the righ
side, and had been overlooked. I
had evidently pressed upon the lower
branches of the sacral plexus, so as
to involve the sphincter and the
gluteal muscles of the left side. The
atrophy was very marked, as shown
in the illustration.

The natural course of spina bifida

is to increase steadily in size; and if the tumour is covered by skin, its growth may be almost unlimited. It has been known to attain a circumference of twenty-two inches. If the integument is wanting, and the sac wall is very thin, rupture is pretty certain to take place, either spontaneously or by some accident, in the course of the first few months; death then results from convulsions owing to the rapid draining away of the cerebro-spinal fluid, or from secondary infection. In a large number of cases death is due to marasmus dependent upon the associated conditions. Infection of the tumour may take place without rupture, the germs passing through the wall of the sac. If the opening communicating with the spinal canal is small, this infection may excite an inflammation limited to the wall of the sac, and result in a cure of the spina bifida, usually with

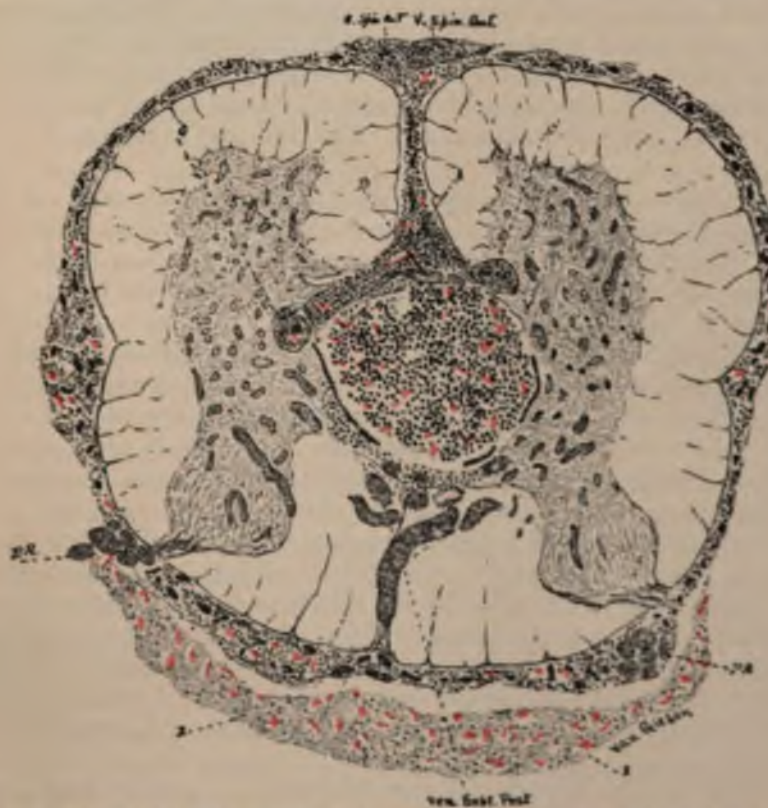

FIG. 154.—Spina bifida, with dilatation of the central canal of the cord, and spinal meningitis. The central canal is filled with round cells, among which are many cocci. *XX* is the pellicle of fibrin upon the posterior surface of the pia mater, also containing many cocci. The pia is everywhere infiltrated with cells, even to the bottom of the anterior fissure. The gray matter of the cord is much congested. *PR* is the posterior nerve root. The section is from the dorsal region of the cord.

sloughing. I have now under observation a girl ten years old in whom this occurred in infancy. The site of the former tumour is marked by a large dense cicatrix, and there still remains partial paralysis of the legs. If the opening into the spinal canal is large, inflammation of the sac is usually followed by spinal meningitis, which may extend upward and involve also the meninges of the brain. In a case published by Van Gieson and myself,* in which there was dilatation of the central canal of the cord and hydrocephalus, bacteria penetrated the wall of the sac and travelled up the central canal of the cord (Fig. 134), finally exciting a suppurative inflammation in the ventricles of the brain, in addition to a spinal meningitis. Sections of the wall of the sac and of the cord at various levels showed the same cocci. The child died at the age of three weeks.

Prognosis.—This depends chiefly upon the anatomical variety and the existence of complications. Simple meningocele, when covered by integument, gives the best prognosis, and complete recovery may occur. In meningo-myelocele, if complete paralysis exists, the prognosis is bad; and if there is hydrocephalus, the case is hopeless. In quite a number of cases in which cure has followed operation, hydrocephalus has subsequently developed. Of fifty-seven cases reported by Demme, twenty-five were operated upon, with seven recoveries and fifteen deaths, while in three there was no result; of the thirty-two cases not operated upon, twenty-eight died within the first month, and not one lived over two years,—the causes of death being marasmus, rupture of the sac, and meningitis.

Diagnosis.—It is usually easy to recognise spina bifida, but it is often difficult to distinguish between the different varieties. The absence of a palpable fissure in the spine, perfect translucency, and a pedunculated tumour, all point strongly to meningocele. Paralysis of the sphincters and lower extremities, umbilication of the centre of the tumour, a sessile tumour, a palpable bony fissure, and a large central cicatrix, point to meningo-myelocele. The coexistence of hydrocephalus points to syringo-myelocele.

Treatment.—In all cases the tumour should be protected from pressure, and care taken where it is not covered by integument, that the surface is kept absolutely clean and aseptic. It should be covered with iodoform and bismuth and surrounded by a large pad of absorbent cotton, or a rubber ring-cushion. Complete paraplegia with involvement of the bladder and rectum, hydrocephalus, or extreme marasmus,—all contra-indicate operative interference. In other cases, operation should be considered. The time of operation will depend somewhat upon the nature of the tumour. If it is covered by integument and growing slowly, it is well to wait until the child is at least six months old. In other cases delay is dangerous, because of the liability to spontaneous or accidental rupture.

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* Journal of Nervous and Mental Diseases, December, 1890.

Nothing is to be expected from simple aspiration and compression. The methods of treatment which have been successfully employed are ligation, aspiration and injection, and excision of the sac. Ligation is admissible only where there is a pedunculated tumour; and even for these cases some surgeons prefer the clamp. Aspiration and injection have been widely used both in Europe and America. The needle should never be inserted near the median line. The tumour having been aspirated and about one half of its contents evacuated, there is injected, without removing the needle, a drachm of Morton's fluid (iodine, gr. x; iodide of potassium, gr. xxx; glycerin, ℥ j). If the tumour is pedunculated, pressure should be made at its neck to prevent the entrance of fluid into the canal. In all cases the child should be kept in a recumbent position for several hours. The operation is not entirely free from danger, as in some cases it has been followed by convulsions and death in a few hours. Considerable inflammatory reaction usually occurs, lasting from two to four days. After this period there is, in a favourable case, a subsidence of the swelling, with a gradual contraction and finally obliteration of the tumour. In some cases two or three injections may be required. The mortality of cases treated by this method is from forty to fifty per cent.* My own experience includes four cases, with two recoveries.

The dangers of this operation and the uncertainty as to its results have led many surgeons to discard it altogether in favour of excision, which with the technique of modern surgery is almost devoid of risk. For a description of this and the various plastic operations that have been proposed in connection with complete or partial excision of the sac, the reader is referred to works upon operative surgery. In operating, it should not be forgotten that in the great proportion of the cases (ninety-five per cent, according to the Clinical Society's Report, which, however, refers only to fatal cases) some part of the cord is in the sac. The cord is often present in tumours situated below the third lumbar vertebræ, owing to its attachment to the sac.

Although recovery may follow operation, in a very large number of cases it is incomplete; some degree of paralysis, with atrophy, contractures, and deformities, remaining because of the implication of cord elements in the sac.

SPINAL MENINGITIS.

In acute meningitis usually only the pia mater is involved. This rarely occurs alone, unless it is due to traumatism. It is most frequently associated with inflammation of the pia of the brain, and may occur either with

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* Report of the London Clinical Society.

the simple or the tuberculous v
flammation of the pia mater accc
elitis.

Chronic spinal meningitis in
Inflammation of the external lay
secondary to caries of the verteb
on Compression-Myelitis.

Symptoms.—The symptoms of
no matter with what pathological
to irritation of, or pressure upon,
are most common are: pain in
ment, and usually by pressure upo
following the course of the spin
the trunk; rigidity of the spinal
cles, or rigidity of the muscles
along the spine, which may be qui
is added, there is paralysis or pa
anæsthesia. Any of the above sym
ing to the nature of the primary d

The diagnosis between spinal n
for except in acute cases the two p
given case it may be difficult to d
of the membranes is the more im
derness, spasm, and irritative syn
while loss of power and anæsthesia
pain, tenderness, and other irrita
paralysis and anæsthesia may be co

Treatment.—This is first of the
addition, counter-irritation by mea
and in severe cases even immobiliz
port. Iodide of potassium is often

MY

Myelitis is a rare disease in child
which are discussed under separat
acute poliomyelitis. Otherwise m
it may occur as a complication of a
pecially typhoid or scarlet fever, ar
disease, where it is attributed to ex
infectious. Chronic myelitis may

Myelitis usually occurs in childr
it may be transverse, diffuse, or dis
subacute, or chronic. The lesions
same as when the disease occurs in

Symptoms.—Myelitis usually comes on rather gradually, with only local symptoms; but the onset may be quite acute, with severe general symptoms,—fever, pain, prostration and localized or general convulsions. The local symptoms vary with the seat and the extent of the disease.

In transverse myelitis loss of power and anæsthesia are present below the level of the lesion; either of these may be partial or complete. At the level of the lesion there is a zone of hyperæsthesia and "girdle-pains." All the reflexes below the seat of the lesion are exaggerated. Those at the level of the lesion are lost. There may be loss of control of the sphincters, bed-sores, degenerative changes in the paralyzed muscles, contractures, and vaso-motor disturbances. The paralyzed muscles may be rigid or flaccid according to the seat and extent of the lesion.

When transverse myelitis is situated in the cervical region there are paralysis and anæsthesia of the arms, legs, and trunk. All the reflexes are exaggerated, and there is general rigidity of the paralyzed muscles. There are incontinence of fæces and retention of urine, followed by incontinence from overflow. The pupils are frequently contracted, and there may be optic neuritis. Atrophy, when present, usually affects the muscles of the arms, and indicates that the cord to a considerable extent is involved. There is great danger to life, owing to paralysis of the muscles of respiration.

When the seat of disease is the dorsal region, the symptoms are similar to those above described, with the exception that the arms escape, and that the eye-symptoms are usually wanting. This is the most favourable seat for the disease.

When the disease is situated in the lumbar region, in addition to paraplegia and anæsthesia of the legs, there is, from the beginning, incontinence of urine and fæces. The knee reflexes are lost; the muscles atrophy, and usually give the reaction of degeneration. Bed-sores are frequent.

In diffuse myelitis the symptoms are a combination of the above groups. If a large part of the cord is involved, there are general paralysis and anæsthesia, loss of reflexes, marked trophic disturbances, bed-sores, etc.

The course of myelitis is slow, and it usually progresses steadily from bad to worse. Death is due to exhaustion or complications—cystitis, bed-sores, or hypostatic pneumonia—or to some intercurrent disease. In a small proportion of the cases there may be partial recovery, but very rarely is this complete. The diagnosis is to be made from spinal meningitis, tumours, and hæmorrhage.

Treatment.—The treatment of the early stage consists in the use of ice to the spine, or counter-irritation by means of dry cups, mustard, or the Paquelin cautery. Later, the iodide of potassium should be given in all cases; improvement may follow its use, even when there is no suspicion of syphilis, but large doses are required, and for a long period. Electricity is contra-indicated except in chronic cases, and then but little improvement

is likely to result from its use. I
is careful attention to cleanliness
sores, cystitis, and pneumonia.

COMPRES

Synonyms: Pressure-Paralysis

Compression-myelitis is usual
most frequently complicates this
vertebræ are involved, it being
spinal column is affected. This
size of the spinal canal in its upp
plegia is seen in fifty per cent of
the spine. Essentially the same c
may result from tumours of the sp
pachymeningitis. These, howeve

Lesions.—In spinal caries the
ease a softening of the bodies of t
pressure due to the superincumb
backward projection known as t
spinal canal is encroached upon
whose ligamentous attachments
matory products the result of peri
dura mater, chiefly of the externa
internal layer also. All these con
of inflammatory material, often c
chiefly in front of the cord, but m
place slowly in most of the cases,
mentioned. In a small number o
from the slipping backward of one

In recent cases the cord at the
than normal. It is usually involv
to two inches. Paraplegia may ha
the cord are very slight, and some
the naked eye. In more protract
much smaller at the point of diseas
changes of interstitial myelitis (G
there are degeneration of the nerve
appearance of the ganglion cells, wi
fibres; sometimes all distinction be
lost. In addition to these marked
may be ascending or descending de

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* Journal of Mental and

There is usually inflammation of the nerve roots, which have also suffered compression. It is in many cases surprising to see to what degree the cord may be compressed and still preserve its functions.

Symptoms.—In caries of the cervical region the symptoms of compression-myelitis not infrequently precede the deformity, and, in fact, the other objective symptoms of bone disease. The earliest symptoms of caries usually arise from irritation of the nerve roots, and consist of acute pains not often referred to the spine, but radiating to the different regions to which these nerves are distributed. They are felt in the neck, in the chest, in the epigastrium, and sometimes in the loins. Such symptoms indicate the presence of pachymeningitis, and may be present whatever the location of the vertebral caries. Accompanying these pains, there is noticed a gradual weakness in the lower extremities, and sometimes also in the arms, according to the location of the disease. This may steadily increase for several weeks until there is complete paralysis. Other symptoms are then commonly present. There is usually some degree of anæsthesia, but in many cases there is none, and there may be numbness, tingling, formication, and pain. The sphincters are not often involved. When the disease is in the upper half of the cord, there are rigidity of the extremities and great exaggeration of all the reflexes, with marked ankle-clonus. In the rare cases in which the lumbar enlargement is involved, there may be loss of reflexes, paralysis of the sphincters and bed-sores.

The distribution of the paralysis will depend upon the point of compression. If this is in the cervical region, all four extremities will be paralyzed; if in the dorsal region, only the legs. In rare cases the paralysis is unilateral, and if there is no spinal deformity the condition may be a most puzzling one. According to the extent of the secondary lesions in the cord, there may occur muscular atrophy and contractures. With disease in the upper cervical region, death may result from sudden pressure upon the cord, owing to a dislocation of the odontoid process, which happened in one of Gibney's cases; or there may be vomiting, pupillary symptoms, irritation of the phrenic nerve causing hiccough, or pressure causing paralysis of the diaphragm.

Course and Prognosis.—These depend much upon the treatment of the case. In many cases of paralysis occurring early in caries, complete recovery takes place in the course of a few weeks, sometimes in a few days, after the application of a proper mechanical support. This may be true even where the paralysis has continued for three or four months. In the cases which have been long neglected, or those in which the paralysis develops while proper mechanical treatment is being carried out, the chances of improvement, or at least of rapid improvement, are not nearly so good. Gibney gives the following statistics of fifty-eight cases under his personal observation: thirteen proved fatal, six dying from myelitis, five from other diseases subsequent to recovery from the paralysis, and two from

tuberculosis before complete rec
paraplegia, but relapses occurred
recovering subsequently; fifteen
time of the report. The usual
eighteen months. Complete reco
have persisted for four or five year
no matter how long the sympto
atrophy with loss of electrical reac

Diagnosis.—This is rarely diff
in every case where the sympto
on without definite cause. The
stiffness of the spine in walking,
reflexes and ankle-clonus,—all
They are sufficient to warrant th
no deformity exists. When the
mistakable.

Treatment.—The most importa
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for any reason this is impossible,
two other measures which promise
tery, and the internal administrati
extensive experience, Gibney has n
else except mechanical treatment.
sixty to ninety grains being given
servation of many of Gibney's cases
ficial effect of the iodide, and to th
by children in the doses indicated
in weight while taking the drug,
iodide should always be largely dil
carefully watched, kept scrupulous
quently to prevent the formation
indicated. When the paralysis dev
may sometimes be obtained by the
is to be expected from this in the sl

INFANTILE SP

Synonyms: Acute Poliomyel

This disease is characterized by
symptoms, by an early and usually e
siderable degree of spontaneous imp
muscles which remain permanently
and marked atrophy. A chronic
adults, but this is rarely, if ever, see

Acute poliomyelitis is the most frequent cause of paralysis in early life and it is often designated simply as *infantile paralysis.*

Etiology.—In 566 * cases the age at which the paralysis developed was as follows:

During the first year	20	per cent.
" " second year	38	"
" " third year	22	"
" " fourth, and fifth years	15	"
After " fifth year	5	"

From this table it will be seen that the great proportion of cases develop before the fifth year, and that eighty per cent of them begin during the first three years, the most frequent period being the second year.

Boys are rather more frequently affected than girls. In the series referred to, fifty-five per cent were males and forty-five per cent were females. Hereditary influences seem to have but little effect in the production of this disease. It is rare to find several cases in the same family, or to trace any relation to nervous antecedents. The onset of the great proportion of the cases is in summer. Of Sinkler's cases, eighty per cent began during the five warm months. This fact is decidedly against the theory so often advanced, that the disease results from exposure to cold. There are, however, a few cases in which the connection between exposure and the disease seems to be a close one. On account of the time of onset—most frequently in the second year—the disease is often ascribed to dentition. In my series this was given as the cause in one fifth of the cases. The connection is at most merely a coincidence. Traumatism is sometimes given as a cause, but the proportion of cases in which the paralysis can be fairly attributed to injury is very small, yet there are a few in which a definite injury of considerable severity has immediately preceded the onset. In about twelve per cent of the cases above mentioned the paralysis came on as a sequel to some other acute disease; this list includes nearly all the diseases of infancy, those most frequently noted being diarrhœa, scarlet fever, and measles; but in the great proportion of the cases the patient was in good health at the time of the attack.

The essential cause of the disease is as yet unknown. On account of the close relation of the lesion to the distribution of the blood-vessels, there has been of late a disposition on the part of many observers to regard it as infectious, the cord changes being the result of infectious embolism or thrombosis.

Lesions.—Infantile spinal paralysis is due to an acute inflammation of the gray matter of the anterior portion of the spinal cord. The late

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* These statistics and those which follow in this article are derived from the following sources: Sinkler, in Keating's Cyclopædia, vol. iv, 355 cases; Galbraith, American Journal of Obstetrics, 1894, 75 cases; the remaining 146 are personal cases and others taken from the records of the Hospital for Ruptured and Crippled, New York.

changes which occur in the c
many years been well establish
matter of dispute, owing to the
cord during the stage of acute in

In autopsies made upon cas
affected is distinctly smaller th
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shrunken and deformed and sca
entire gray horn is much smaller
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smaller than in the sound half
of the affected side are smaller
to the muscles. The general ch
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treme cases a complete disappear
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severe the fibres are small. The
smaller than upon the sound si
those of the anterior ganglion-cell

The most recent observations
Siemerling, Goldscheider, and ot
lesion is an interstitial inflamma
was formerly believed. Goldschei
first changes are in the blood-ve
the neuroglia and produces a pr
ganglion cells are degenerative in
just described; the same is true
Accompanying the process in so
observed.

The region of the cord most
largement, but there may be mo
only one lateral half of the cord
sides to be involved. In such ca
vanced upon one side than the oth

Symptoms.—A frequent form o
suddenly ill with vomiting, pains in
a temperature of from 101° to 103°
a variable time, usually from one
ered. In a smaller number of ca
number—the attack is ushered in

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* Goldscheider, Zeitschrift für klin.
Diseases of Children, 1895, p. 310.

toms. There are convulsions, delirium, a temperature of 103° or 104° F., marked general prostration, constipation, severe pains in the back and extremities,—in short, all the symptoms of a severe acute inflammation. These symptoms last from two days to a week, often engrossing the attention of the physician, so that the paralysis may not be noticed until the patient has been sick for some time, or possibly not until the beginning of convalescence. In quite a large number of cases the general symptoms are very slight, and they may be absent altogether. A not infrequent history is that the child went to bed apparently well; during the night was noticed only to be a little restless, and that the next morning the paralysis was discovered. In two cases of my series the paralysis came on quite suddenly while the child was walking in the street, and was able to reach home only with considerable difficulty. In such cases it is not improbable that previous symptoms were present, but were so slight as to have escaped notice.

In most of the cases there are pains in the back, in the muscles of the extremities, or along the course of the spinal nerves. With these pains general hyperæsthesia is commonly associated, and there may be other disturbances of sensation such as numbness and tingling. The development of the paralysis is quite rapid, it often attaining its maximum in twenty-four hours; although sometimes it will be two or three days, or even a week, before its full extent is seen.

Extent and distribution of the primary paralysis.—In 560 cases in which this point was noted the distribution was as follows:

One lower extremity	229	cases.
Both lower extremities	176	"
General paralysis of all extremities, and more or less of trunk	79	"
One lower and one upper extremity	36	"
Both lower extremities and one upper extremity	16	"
One upper extremity alone	14	"
Both upper extremities	2	"
All other varieties	8	"

In paralysis of the trunk, the diaphragm and other respiratory muscles are very rarely affected. In combinations of an upper and a lower extremity, the limbs are more frequently affected upon opposite sides than upon the same side. The sphincters almost invariably escape.

Course of the disease.—The rapid development of the paralysis is followed by a period of from one to four weeks' duration in which but little change is seen in the affected muscles. This is followed by spontaneous improvement, which, according to Gowers, begins in the muscles last affected, and generally reaches its limit in about three months. After this time but little spontaneous improvement is to be looked for, and the residual paralysis is likely to be permanent. By the end of two months marked atrophy is present in the paralyzed muscles. The affected limb is distinctly smaller than its fellow, this being quite apparent even in infants. Except at the onset, sensory disturbances are absent; the knee-jerk is lost in paraplegic cases, and in those in which the extensors of the thigh are paralyzed. There is arrested growth in the whole limb (Fig. 135). It becomes much smaller and shorter than its fellow. The great relaxation of the ligaments at the joints may allow subluxation, especially at the knee and at the shoulder. The circulation in the affected limb is poor; it is often blue and cold, but bed-sores are never seen.

Electrical reactions.—Very early in the disease the atrophied muscles begin to lose their power to respond to faradism. In the muscular groups which are to be permanently paralyzed, the faradic response may be lost in a week. The muscles in which recovery is to take place often preserve a certain degree of contractility, although this is less than normal, and improves later. The response to the galvanic current may be increased for a few months, and then slowly fail as the muscular fibres themselves degenerate, and at the end of two or three years it may disappear altogether. The reaction of degeneration is present with great uniformity in the atrophied muscles, but in them alone.

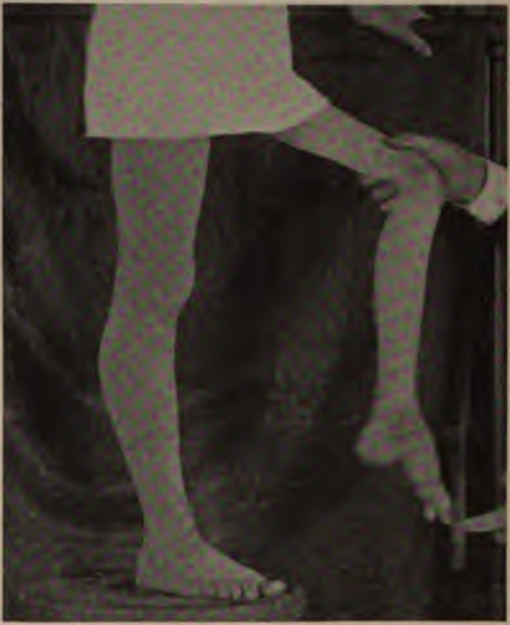

FIG. 135.—An old case of infantile spinal paralysis of the entire left lower extremity, showing extreme atrophy of the thigh and leg, and a very characteristic deformity of the foot.

Residual paralysis and deformity.—Only one lower extremity is involved in half the cases, and the paralysis is usually incomplete and confined to certain groups of muscles. The extensors both of the thigh and of the leg are nearly always involved to a greater degree than the flexors, and in very many cases only the extensor groups are paralyzed. The muscles most frequently affected are the anterior tibial group, and next the peroneal group. The most frequent deformity resulting from this paralysis is talipes valgus, and next to this talipes varus, both of these being usually associated with a certain amount of equinus. In very rare cases there is talipes calcaneus. Most children with paralysis of only one lower extremity are able to walk alone, or with the assistance of a steel brace.

Paralysis of both lower extremities is the next in frequency. This also is rarely complete. In forty-three cases of my series there was originally complete paraplegia, but it was permanent in only three. The extent of recovery varies much in different cases. Usually one leg recovers to a much greater degree than the other. Most of these patients are able to walk with the assistance of braces, a few only by the aid of crutches. Some walk while they are young, but are unable to do so when fully grown, because the disproportion between the size of the body and the limbs is then much greater.

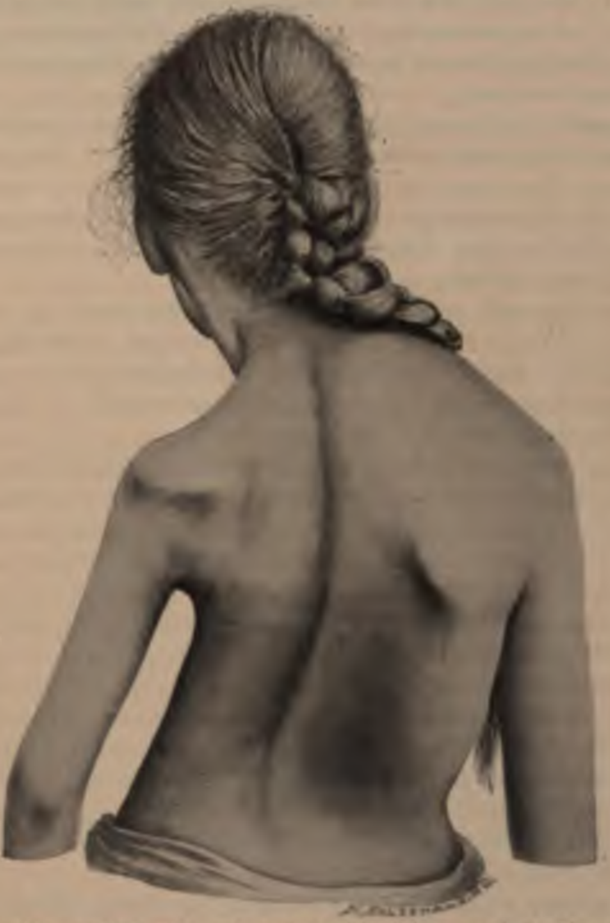

FIG. 134.—An old case of infantile spinal paralysis of the left arm and shoulder muscles, with resulting lateral curvature. The spinal deformity is increased by the fact that the patient had also suffered from empyema of the left side.

Paralysis of one upper extremity rarely occurs alone, but is associated with paralysis of one or both lower extremities. Complete paralysis of an arm is rarely, if ever, seen. The muscular groups affected may be the small muscles of the hand, the muscles of the forearm,—especially the extensors,—or the shoulder group. Of single muscles, the one most frequently involved is the deltoid; this may result in subluxation of the shoulder. From paralysis of the muscles of the trunk or shoulder of one side, lateral curvature may develop (Fig. 136). If the serratus magnus is affected the scapula stands out prominently, giving rise to the so-called "angel-wing" deformity.

Diagnosis.—The general symptoms of the onset have nothing characteristic about them, and no diagnosis can be made until the paralysis has taken place. The acute onset, the rapid wasting, the spontaneous improvement in certain groups of muscles, the absence of sensory symptoms, and finally the reaction of degeneration,—all constitute a type which it is difficult to confound with any other disease.

At the onset this paralysis may resemble that resulting from acute transverse myelitis. In the latter, however, we get anæsthesia, exaggerated knee-jerk, ankle-clonus, generally involvement of the sphincters, a tendency to bed-sores, slight wasting, and no reaction of degeneration. It is, besides, extremely rare.

Multiple neuritis is in most cases easily distinguished from poliomyelitis by its gradual onset, by the presence of pain and other sensory symptoms as well as loss of power, and by the fact that spontaneous recovery generally occurs within two or three months. Besides, there is usually a history of antecedent diphtheria. But multiple neuritis sometimes begins suddenly with febrile symptoms, and paralysis may occur early, precisely as it does in poliomyelitis. Furthermore, in some cases of neuritis, the sensory symptoms are not marked, and they may have entirely disappeared before the patient is seen. In such cases the diagnosis from poliomyelitis may be difficult or even impossible except by the course of the disease; for atrophy is common to both conditions, and even the electrical reactions may be identical. There is no doubt that some cases formerly reported as examples of poliomyelitis terminating in complete recovery were really cases of multiple neuritis.

The diagnosis from acute cerebral palsy is chiefly difficult when the spinal paralysis has been hemiplegic or diplegic in type, or when after cerebral hemiplegia the leg or the arm has recovered so completely that the case resembles monoplegia. In cerebral palsies there is usually rigidity; there is no reaction of degeneration; other cerebral symptoms are commonly present, or there is a history of an onset with cerebral symptoms; and the atrophy is less marked. The most diagnostic point is the electrical reactions.

Infantile spinal paralysis may be mistaken for other than nervous dis-cases. In the early stage it may be confounded with the pseudo-paralysis of scurvy. I have several times seen the mistake made of diagnosticating paralysis where scurvy was present. In scurvy, however, there are seen excessive tenderness and hyperæsthesia, pain upon motion, especially about the knees, spongy gums, and sometimes ecchymoses about the joints. The muscular weakness of rickets is sometimes mistaken for infantile paralysis. However, in rickets the symptoms are always bilateral, the electrical reactions are normal, and other signs of rickets are present. In all doubtful cases the chief reliance for the diagnosis of paralysis should be placed upon the character of the electrical reactions. The lameness resulting from paralysis may resemble somewhat that due to hip-disease; but with a careful examination there can rarely be any difficulty in making the differential diagnosis.

Prognosis.—Infantile spinal paralysis is accompanied by little, if any, danger to life. It is possible that death may take place during the stage of acute inflammation, but this is certainly extremely rare. The most important question in early prognosis is whether there will be any permanent paralysis, and, if so, what will be its extent. The important symptoms for prognosis are the amount of wasting and the condition of the electrical reactions. Muscles which in ten days have lost completely their faradic contractility are almost certain to waste rapidly and severely. The best indication of coming improvement is the return of faradic contractility. If this is completely lost for six months, recovery is doubtful; if for one year, improvement in these muscles is not to be expected. If faradic contractility has never been lost, very great and early improvement in the paralyzed muscles may be confidently predicted. After three months but little spontaneous improvement is to be looked for, and after two years none at all. Complete recovery is possible only with a lesion of very limited extent; and while it may occur, it is so infrequent that it is never to be expected.

Treatment.—Unfortunately, most of the cases do not come under observation during the acute stage, or the nature of the disease is overlooked until the paralysis has occurred. In the early stage the indications are, to induce free perspiration by hot baths, to keep the patient in a prone or lateral position, and to use counter-irritation to the spine by means of dry cups, mustard, or the Paquelin cautery, or an ice-bag may be placed along the spine. The natural course of the disease is to be kept in mind, for the tendency is to overestimate the effect upon the paralysis of the drugs used in the early stage. On theoretical grounds, ergot is indicated, but it is doubtful whether any drugs have much effect.

After all acute symptoms have subsided, or at the end of two or three weeks, electricity may be used, but its curative effects have been very greatly overestimated. The object in using electricity is to keep up the nutrition of the muscles until the cord has recovered, which it is almost certain to do to a considerable degree. But no amount of electrization can preserve muscles whose ganglion cells have completely disappeared. These continue to waste and lose their faradic contractility, no matter how early electricity is begun nor how faithfully it is continued. Faradism may be used for such groups as respond to it; otherwise galvanism should be employed. The beneficial results from electricity are to be obtained in the first year, chiefly in the first six months. Too much can not be said against the routine use of electricity in cases which have been paralyzed three or four years, with the vain hope that some good may be done, even though there is no response to either current. Strychnine may be used in conjunction with electricity after all symptoms of central irritation have subsided, but there is still great diversity of opinion regarding its effect.

Friction and massage are of undoubted value in improving the circulation and the nutrition of a limb, and should be continued regularly twice a day for a long period.

Mechanical Treatment.—The first use of mechanical appliances is the prevention of deformity. All cases of paralysis should be carefully watched, and braces applied as soon as any tendency to deformity from muscular contraction shows itself. This is much easier than to overcome deformities which have been allowed to develop, and quite as important for the patient. The second use of apparatus is to furnish support to the limb in order to enable the child to walk. By such means many get about with tolerable comfort, for whom locomotion without apparatus is impossible except with crutches. The third purpose of apparatus is, to overcome existing deformities in neglected cases.* Braces are generally used in conjunction with myotomy or tenotomy of the various shortened tendons, excision of portions of elongated tendons, and the production of artificial anchylosis in cases of "flail joints." By these means the orthopædic surgeon is able to give a great deal of relief to these unfortunate and sometimes helpless patients.

On the whole, the treatment is extremely unsatisfactory, and the result depends upon the severity and extent of the original disease, rather than upon the particular line of treatment adopted or the time at which it is begun.

TUMOURS OF THE SPINAL CORD.

Tumours of the cord are exceedingly rare in childhood, and almost unknown in infancy. The most common varieties seen in early life are glioma, sarcoma, and tuberculous tumours. Eisenschitz has reported a case of tuberculous tumour in the dorsal region occurring in a child of three and a half years. There was a similar growth in the cerebellum. The symptoms were essentially those of compression-myelitis.

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* See Gibney, New York Medical Journal, April 3, 1886, On the Limitation of Therapeutics in Infantile Paralysis.

In my service at the Babies' Hospital I recently had a case of glioma of the cord in a child only one year old, which was in many respects unique. The early symptoms were gradual paralysis of the upper extremities, to which were added later, stiffness of the neck, and finally immobility of the head,—the position being that of typical cervical caries. During the sixteen days of observation there was high fever, from 101° to 104° F. There were no pupillary or vaso-motor symptoms. At the autopsy the cord was found to be the seat of a diffuse gliosis. In the cervical region there was marked enlargement, the cord being fully four times its natural size. A microscopical examination by Dr. C. A. Herter showed that the growth apparently began in the vicinity of the central canal, and that the gliomatous process involved the entire length of the cord.*

A somewhat similar case has been reported by Miura in a boy of eight years.

The diagnosis of tumours of the spinal cord in infancy is practically impossible. In later childhood they are most apt to be mistaken for Pott's disease, but the symptoms are the same as those seen in tumours of adult life.

SYRINGO-MYELIA.

Syringo-myelia, although a rare disease, is sometimes seen in early life. The term is applied to a condition in which there is a cavity in the cord the result of a pathological process, in contradistinction to the cases in which a cavity is the result of a malformation, or *hydromyelus*, although it is not infrequent for the two conditions to be associated. The pathological process which precedes the cavity formation is now thought to be, in most cases at least, an infiltration of the substance of the cord with gliomatous cells. The process is somewhat similar to that just described in the case of tumour of the spinal cord, with the exception that where it results in cavity formation it is slower. The infiltration in these cases usually begins near the central canal. It is followed by a degeneration and breaking down of the infiltrated areas, beginning at the centre. As the cavity forms it extends, and usually first invades the gray matter of the commissure, later the posterior gray horns, the posterior columns, or the anterior horns. The resulting cavity is usually irregular in shape, and may be very small, or may extend through a large part of the length of the cord. It is most frequently situated in the lower cervical and upper dorsal regions. It is filled with fluid, and surrounded by gliomatous tissue.

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* For a full report of this case by Dr. Herter and myself, see American Journal of the Medical Sciences, April, 1895. See also Kohts, Beitrag zur Diagnostik der Rückenmarkstumoren im Kindesalter, Dresden, 1886.

According to Starr, the essential symptoms are of three kinds: (1) There is progressive muscular atrophy, with paralysis of some or all the muscles of one limb, usually extending to the opposite limb and to the trunk, sometimes accompanied by the reaction of degeneration; (2) vaso-motor and trophic disturbances in the affected limb, such as cyanosis, coldness, bullous eruptions, ulceration, abscesses, atrophy, and sometimes fragility of the bones and diminution of perspiration; (3) sensory disturbances, which are probably the most characteristic symptoms of the disease,—there is loss of the sense of pain and of temperature in the atrophied part, while the sense of touch and of location may be preserved. The extent and distribution of these symptoms will of course depend upon the position of the disease.

The course of syringo-myelia is essentially chronic, the duration being usually several years; and although spontaneous arrest sometimes occurs the disease is in most cases steadily progressive.

The cause is unknown, and it is not influenced by any form of treatment.

FRIEDREICH'S ATAXIA.

This is a chronic disease of the spinal cord and medulla, which begins most frequently in childhood or about puberty. The lesion affects first the posterior columns, afterward the crossed pyramidal tracts, the direct cerebellar tracts in the lateral columns, and Clarke's vesicular columns in the gray matter of the cord. There is probably some disease of the medulla, the pons, and possibly of the cerebellum and the posterior nerve-roots. In advanced cases other parts of the cord may be involved. The disease is seen in certain families, often affecting several members in succession at about the same age. It occurs particularly in families where alcoholism, insanity, and other nervous diseases are frequent.

Bramwell, in his monograph upon this disease, gives the following as the characteristic symptoms: There is ataxia, first of the lower extremities, but gradually extending to the upper extremities and the face. Early in the disease there is some weakness in the legs, especially in the anterior group of muscles. In the late stages this is marked and accompanied by atrophy. The gait is peculiar, like that of ordinary ataxic patients, the difficulty in walking being due to the ataxia and not to the paresis. After a time there is produced a characteristic deformity of the foot,—it is shortened, as if from pressure against the toes and the heel, the instep is high, and the extensor tendon of the great toe stands out prominently. This deformity is seen quite early in the disease. There is often lateral curvature of the spine. The knee-jerk is absent. Unprovoked and uncontrollable laughter is quite a characteristic symptom of the disease. The patient is unable to stand with his eyes closed. There are palpitation, occipital headache, and sometimes vertigo. In the later stages speech is slow and difficult, and the patient talks like one intoxicated. The expression of the face is vacant, and often nystagmus is present. There may be choreic movements. The symptoms steadily progress until the patient may be helpless, although the general health may remain good for years.

The disease is distinguished from locomotor ataxia by the absence of the "lightning pains," and of the bladder, rectal, or genital symptoms, the pupillary changes, the optic-nerve atrophy, and the trophic changes in the bones and joints. It is distinguished from cerebral tumour by the absence of headache, vomiting, and optic neuritis, and by its longer course. The progress of the disease is slow but steady. It may last from twenty to thirty years. It is incurable.

LANDRY'S PARALYSIS (ACUTE ASCENDING PARALYSIS).

This rare disease is occasionally seen in early life. In regard to its etiology but little is definitely known, the usual causes assigned being the same as those of myelitis.

It is characterized by a paralysis—sometimes preceded by general symptoms of *malaise*, fever, etc.—which begins in the legs and spreads rapidly to the muscles of the trunk and upper extremities; finally it may involve the neck, diaphragm, and muscles of articulation. The paralysis develops quite rapidly, often attaining its height in from twenty-four to forty-eight hours, sometimes even proving fatal within this time. In other cases it comes on gradually, and may be two or three weeks in reaching its maximum. There is dyspnœa from involvement of the muscles of respiration. The paralyzed muscles are flaccid. There is hyperæsthesia, followed by partial or complete anæsthesia and loss of reflexes. There are no changes in the electrical reactions, no atrophy, no bed-sores, and usually no involvement of the sphincters. Occasionally the arms may be affected before the legs, and even the bulbar symptoms may be the first noticed. Death is the most frequent termination, and in fatal cases the disease lasts from two days to a week. If recovery takes place, it is after two or three months of illness.

The pathology of the disease is as yet unknown. The indications for treatment are the same as in acute myelitis, for in the beginning the two diseases can not usually be distinguished from each other.

THE MUSCULAR ATROPHIES.

These cases may be broadly divided into two groups, following in the main the classification of Sachs:* (1) Those dependent upon disease of the spinal cord,—the spinal atrophies; (2) those which are primarily diseases of the muscles themselves,—the idiopathic atrophies.

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* New York Medical Journal, December 15, 1888.

In the group of atrophies of spinal origin belong (1) the "hand type" of Aran and Duchenne, which has been shown to be dependent upon a lesion of the spinal cord; (2) the "peroneal type" of Charcot, Marie, and Tooth, which as yet lacks positive pathological proof of its spinal origin, although its etiology, symptoms, and course leave but little doubt that it belongs in the same category with the hand type.

In the second (idiopathic) group are included (1) pseudo-muscular hypertrophy, and (2) the so-called "juvenile atrophy" of Erb, which is a much less frequent condition. These two varieties have the following features in common: There is progressive wasting, beginning early in childhood, and associated at some period with hypertrophy of certain muscles. There are no fibrillary contractions, no reaction of degeneration, and no lesions in the cord. From a pathological point of view these diseases might be more properly considered elsewhere, but they are so closely associated clinically with the spinal atrophies that it has seemed better to describe them in this connection.

Progressive Muscular Atrophy of the Hand Type.—This disease is characterized by a very slow but progressive wasting, which usually begins in the muscles of the ball of the thumb of one or both hands. Then the palmar group of muscles belonging to the little finger are affected, and later the interossei. When the wasting has reached a certain degree, there is produced a peculiar and characteristic deformity of the hand known as *main en griffe*, or "claw-hand." Following these muscles, those of the forearm may be affected. At this point the disease is sometimes arrested, or the atrophy may extend to the muscles of the arm and shoulder, especially the deltoid, and finally to those of the back. Exceptionally, the atrophy begins in the muscles of the shoulder group or even in those of the leg. The wasting takes place very slowly, the muscles disappearing fibre by fibre, but the degree which may be reached is often extreme. The only other characteristic symptoms are fibrillary contractions in the muscles which are soon to atrophy. The patient is not conscious of them, but they are visible. The faradic contractility is preserved just in proportion to the amount of muscle remaining. If the atrophy is complete, it is entirely lost.

The course of the disease is a very chronic one, covering many years. It is incurable. In rare cases the process may extend to the muscles of the tongue, affecting deglutition and articulation, and death may occur from interference with respiration; otherwise the disease does not tend to shorten life.

In this form of atrophy heredity is an important etiological factor. The disease may occur in children, but very often does not begin until after puberty. The lesion consists in an atrophy of the ganglion cells of the anterior horns of the spinal cord, followed by secondary degeneration of the anterior nerve-roots.

Progressive Muscular Atrophy of the Peroneal Type.—This is much less frequent than the variety just described. In this form, the first to waste are the anterior muscles of the leg, especially the extensor longus hallucis and extensor communis digitorum, afterward the peroneal group. The small muscles of the foot are next affected, and the disease may then go on to involve the muscles of the calf. At this point it may be arrested permanently, or for several years, after which the thigh muscles may waste like those of the leg. After many years the hands are in some cases involved as in the type previously described, and even the muscles of the forearm. As a rule, the supinator longus, the muscles of the shoulder, neck, trunk, and face, escape altogether. The atrophy is generally symmetrical, but not invariably so. The cutaneous reflexes are usually present. There is no pain. The reaction of degeneration is present in some of the muscles, and fibrillary contractions are frequent, but not always seen.

In this variety also the influence of heredity may often be traced. It is said that boys usually inherit the disease through the mother. Like the previous type, it begins late in childhood or not until after puberty.

As stated above, positive proof that this disease is due to a central lesion in the cord is as yet lacking. Analogy, however, leads to the belief that it depends upon changes in the ganglion cells of the anterior horns in the lumbar region, similar to those found in the cervical region in the hand type. The course of the disease is very chronic, and it, too, is incurable. The resulting deformity resembles that seen after poliomyelitis, and may require the same mechanical treatment, with similar operations for relieving contractions.

Pseudo-Muscular Hypertrophy (Pseudo-Hypertrophic Paralysis).—This is the most frequent and best-known variety of the idiopathic atrophies. It is a disease of certain families, often three or four children being affected, the boys much more frequently than the girls. The symptoms as a rule come on early in childhood, nearly always before the tenth year. The earlier symptoms relate to a general weakness of the lower extremities, which is accompanied by a marked increase in the size of certain muscular groups, usually those of the calves, but sometimes more of the thighs or the gluteal regions. Children walk late and unsteadily, and fall very easily. They have special difficulty in rising from the floor and in mounting stairs. The method of rising is quite characteristic: the patient lifts his body until he touches the floor only with the hands and feet; then he proceeds to "climb up himself" by putting first one hand upon the knee, and then the other, gradually moving his hands higher and higher up the thighs until the erect position is attained. This is seen in most of the cases, but not in all.

The size attained by the calves is sometimes very great. Gowers mentions a case in which a boy of twelve had calves measuring fourteen and a half inches in circumference. The enlargement may affect almost any muscular group of the lower extremity. In the upper extremity, the infra-spinatus is most frequently enlarged, next the supra-spinatus and the deltoid. The pectorals and latissimus dorsi are never enlarged, but are generally markedly wasted. Most of these patients exhibit while standing a marked degree of lumbar lordosis, due to the weakness of the extensors of the hip. This is well shown in Fig. 137. The patient may be so weak upon his legs that the slightest touch will cause him to fall, even with his apparently immense muscular development. The small muscles are generally weaker than those which are enlarged.

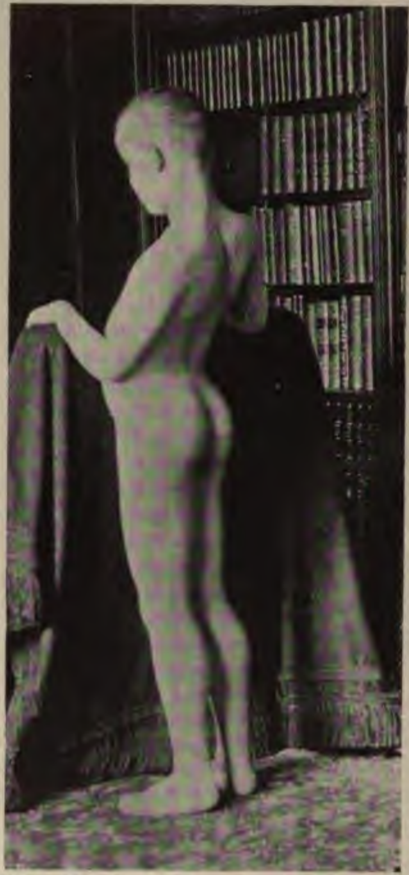

FIG. 137.—Pseudo-muscular hypertrophy, showing to a moderate degree the large calves and gluteal regions with a marked lordosis. (From a photograph by Dr. M. A. Starr.)

Later in the disease marked atrophy occurs with a corresponding weakness of all the affected groups, and the patient may be unable to walk or even stand. With the exception of the use of his hands, he may be absolutely helpless. The knee-jerk is at first normal, but gradually diminishes until it is finally lost. The electrical reactions are normal until marked wasting occurs, when there is a lessened response to faradism and galvanism, but never the reaction of degeneration. There are no fibrillary contractions, and no sensory disturbances. The progress of the disease is generally slow, and sometimes irregular. It is often more rapid in early childhood, and slower after puberty.

The lesions are confined to the muscles. At autopsy they appear yellow, and microscopically there is found very marked atrophy of the muscle fibres, which in places have been almost entirely replaced by fat; there may be no trace of muscle left, the structure resembling adipose tissue. In other places there is an accumulation of fat between the atrophied muscle fibres, and a very great increase of the interstitial tissue.

The prognosis is grave, most patients dying before adult life is reached. The diagnosis is generally easy from the apparent hypertrophy and actual weakness of the muscular groups. The disease is incurable.

The Juvenile Form of Muscular Atrophy.—This is much less frequent than the form just described, but, like it, begins in childhood or early youth. It is characterized by progressive wasting of certain muscular groups, especially those about the shoulders and pelvis, and hypertrophy of others. Of the shoulder and upper extremity, the muscles affected are the pectorals, the trapezius, the latissimus dorsi, the serrati, the rhomboidei, the muscles of the upper arm, and the subscapularis. The deltoid, infra-spinatus and supra-spinatus for a long time escape, and may be hypertrophied. The hand and forearm are not involved. In the lower extremity, the muscles of the pelvis, thighs, and gluteal regions are affected, while those of the leg and foot escape. With this atrophy there may be associated a true or pseudo-hypertrophy of certain muscular groups. In this disease there are no fibrillary contractions, no reaction of degeneration, and no sensory disturbances. The course and result of this form are essentially the same as in the preceding variety. It is now generally regarded as closely allied to it in its pathology, the most important difference being that of localization.

There has been described, chiefly by Landouzy and Déjerine, another form of atrophy known as the *infantile facial type.* In this, wasting begins in the muscles of the face; the lips are thickened, but all the rest of the facial muscles are markedly atrophied, giving a peculiar expression to the mouth known as "the tapir mouth." Later, the atrophy extends to the shoulders and arm, but does not involve the supra-spinatus or infra-spinatus, or the flexors of the hand and forearm. This is sometimes described as beginning in the shoulders, or even in the legs. The description therefore corresponds to the juvenile form of Erb, with the addition of facial symptoms, and it is probably a variety of the same disease.

CHAPTER V.

DISEASES OF THE PERIPHERAL NERVES.

MULTIPLE NEURITIS.

UNDER the term multiple neuritis are included those cases in which several nerves are involved in an inflammatory process, which may at times be general. In its distribution multiple neuritis is usually symmetrical, but it is not necessarily so.

Etiology.—The chief cause of multiple neuritis in children is diphtheria, although it is occasionally seen after other infectious diseases, especially malaria, typhoid or scarlet fever, and measles. In diphtheria the inflammation is due to the direct action of the toxines upon the nerve structures, since it can be induced in animals by injecting toxines into the circulation. There is little doubt that in all infectious diseases the inflammation is excited in a similar way. The metallic poisons, lead and arsenic, are rarely the cause of multiple neuritis in early life, and the same is true of alcohol, although a marked case from this cause has recently come under my observation in a child only three years old.* Lastly, there are cases in which the cause assigned is simply exposure to cold,—those classed as rheumatic.

Lesions.—Almost any nerves in the body may be affected, although the distribution varies somewhat with the cause of the disease. The musculo-spiral and the anterior tibial nerves are most frequently involved, but the inflammation may affect any of the spinal nerves, including the phrenic, and occasionally the cranial nerves, especially the pneumogastric hypoglossal, oculomotor, and abducens. Several nerves in different parts of the body are usually affected, the lesion being in most cases symmetrical.

The affected nerve is sometimes red and swollen, owing to acute congestion and œdema or a sero-fibrinous exudation. In other cases the changes are almost entirely degenerative. The microscope shows the changes sometimes to be chiefly interstitial and sometimes chiefly parenchymatous. There is an exudation of cells into the sheath, between the sheath and the nerve fibres, and even between the nerve fibres themselves. The myeline breaks up into granules, and in places may completely disappear.

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* This case was in many respects a remarkable one. The boy completely emptied a decanter containing twelve ounces of whisky, but almost immediately vomited the greater part of it. He soon after showed the symptoms of alcoholic intoxication, and in a few hours became comatose, in which condition he continued for twelve hours. After this he gradually lost power in his legs, and at the end of a week was unable to walk at all. He had convulsions, and after this there developed the usual symptoms of meningitis at the convexity, with which he was admitted to the Babies' Hospital, December 13, 1895, three weeks after drinking the whisky. The child was then unconscious and there was present incomplete paralysis, affecting all four extremities, with anæsthesia of the arms. The active inflammatory symptoms continued for six weeks longer, during which time there were repeated convulsions, continuous stupor, fever, gradually increasing deformities, marked atrophy, loss of reflexes, and great diminution in the faradic contractility of all the paralyzed muscles; in the thighs, left leg, and abdominal muscles there were no responses to a strong current, but there was nowhere the reaction of degeneration. The child was at death's door for three or four weeks. Three months after the attack the first signs of improvement were observed in the cerebral symptoms. Shortly afterward he began to use his hands, and at the end of six weeks he was walking alone and talking freely. The improvement was very rapid, and eight weeks from the date of the first change for the better, and five months from the time of taking the whisky, he was as well as ever. The diagnosis was multiple alcoholic neuritis, with a convexity meningitis. (Fig. 138 is from a photograph taken while the symptoms were at their height.)

The late changes are those of subacute or chronic degeneration of the nerve fibres.*

With these changes in the nerves there are associated, in some cases, inflammatory and degenerative changes in the ganglion cells of the spinal cord, although they are much less severe than are the lesions in the nerves. However, they were once regarded as the explanation of some of these cases, particularly of diphtheritic paralysis.

Symptoms.—The onset of multiple neuritis is in most cases a gradual one, it being usually from two to four weeks before the paralysis reaches its height. Very exceptionally the onset may be abrupt, with fever, and marked paralysis in a few days. It is characteristic of this disease that both motor and sensory symptoms are present, and that they are the same in their distribution. The symptoms are usually symmetrical. There is first noticed a general weakness in the affected muscles, which slowly increases to complete paralysis. As the extensor groups of the hands and feet are apt to be affected, there are wrist-drop and foot-drop (Fig. 138). The paralysis may begin in the feet and hands, and gradually extend until it involves not only the four extremities, but even the muscles of the trunk and the neck, although this is rare. The child may then be absolutely helpless, unable to sit up, or even to support its head. In such cases the head seems loosely attached to the body, and rolls about on the shoulders like a ball. Weakness of the spinal muscles leads to deformities (Fig. 139), which I have seen mistaken for Pott's dis-

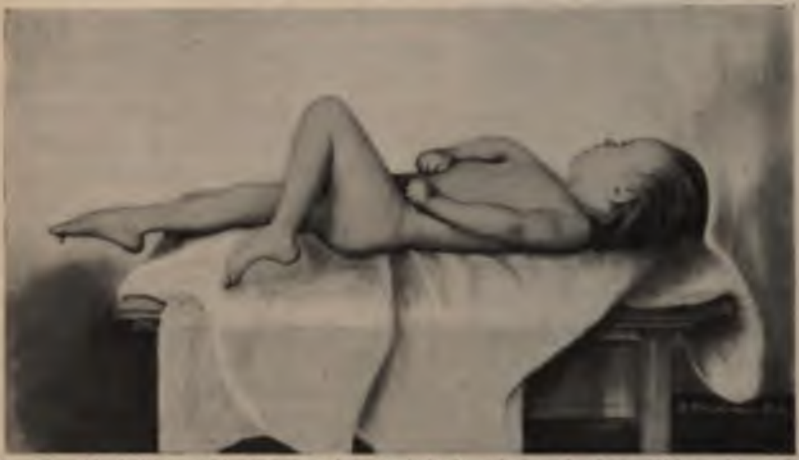

FIG. 138.—Alcoholic neuritis, showing characteristic dropping of the feet. This position of the lower extremities was maintained for over a month. Boy three years old.

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* For a full description of the lesions, consult Starr's Middleton-Goldsmith Lectures, New York Medical Record, 1887.

ease, even by experienced obs
the paralysis is incomplete. T
and the cranial nerves will be
they are rarely seen in any oth
neuritis that the bladder and re

The sensory symptoms are
ease, while the paralysis is incr

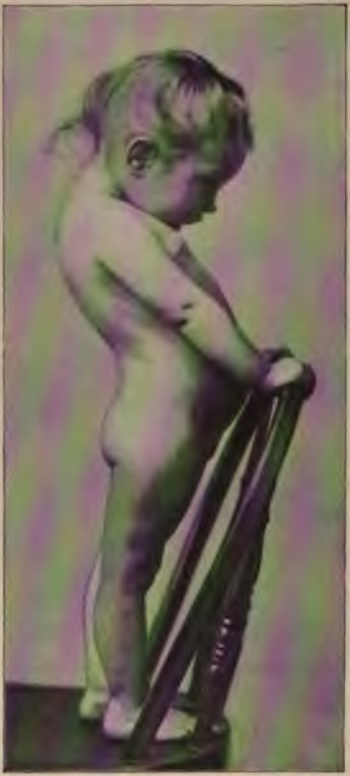

FIG. 139.—Multiple neuritis after diphtheria in a child four years old. The position of the head and spine are due to partial paralysis of the trunk and neck. The legs were also affected.

to the complete reaction of degen
œdema of the affected parts, glos
Deformities from muscular contr
and in some cases, permanent.

Course and Prognosis.—The us
toms gradually to increase for

sometimes rapidly, but more often slowly, the case usually going on to complete recovery in the course of a few months. Exceptionally the paralysis may be permanent. The sensory symptoms always disappear before the motor ones. Multiple neuritis may prove fatal, from paralysis of the heart or the muscles of respiration, or death may be due to asphyxia from the entrance of food or foreign bodies into the air passages, owing to anæsthesia of the epiglottis and paralysis of the muscles of deglutition. Death sometimes follows from complications, especially pneumonia. The electrical reactions are of much prognostic value in regard to the persistence of the paralysis. If the reaction of degeneration is present the paralysis is certain to last many months, and some muscles are sure to be permanently affected. Where there is simply a diminution in the faradic responses, even though accompanied by marked atrophy, complete recovery may be expected, although it is often slow.

Diagnosis.—The diagnostic features of multiple neuritis are the combination of motor and sensory symptoms with the same distribution, the occurrence of atrophy, and the diminution in the electrical responses, even the reaction of degeneration. The gradual onset and the wide-spread distribution of the paralysis are also characteristic. If all four extremities are paralyzed, it is altogether the probable disease; and if to this is added paralysis of the neck and spinal muscles, the diagnosis is almost certain. The facts that the paralysis is often incomplete, and that it involves parts distant from each other, are also important. It may be mistaken for poliomyelitis (page 776), for Landry's paralysis, or for Pott's paraplegia; an important diagnostic point from the last mentioned is the condition of the reflexes,—being greatly exaggerated in Pott's paraplegia, while they are diminished or lost in multiple neuritis.

Treatment.—As this disease tends in the great majority of cases to spontaneous recovery, it is difficult to estimate the value of any method of treatment. Causes, such as lead, arsenic, alcohol, and malaria, are to be sought and removed as the first step. During the acute stage the pain may be so severe as to require relief, which is best accomplished by the application of heat. In using counter-irritation care is necessary, and such active measures as cauterization should not be employed, for troublesome ulceration may follow. After the acute stage has passed, or at the end of three or four weeks, electricity should be begun, faradism being used if the muscles respond to a moderate current, otherwise galvanism. This should be continued daily until recovery. Strychnine is much used in these cases, but it is doubtful whether it has any specific influence, although as a tonic it is valuable. Other tonics, such as iron, quinine, and most of all cod-liver oil, should be given in every case. Massage is also beneficial. The special treatment of cardiac and respiratory paralysis will be discussed in the following article.

DIPHTHERITIC PARALYSIS.

This is not only the most frequent variety of multiple neuritis, but it has some peculiarities which make a separate consideration of it desirable.

Frequency.—According to the statistics of various observers, paralysis including all varieties, occurs after diphtheria in from 5 to 15 per cent of the cases. Sanné gives 11 per cent in 2,448 cases; Lennox Browne, 14 per cent in 1,000 cases; the Report of the Collective Investigation by the American Pædiatric Society, 9·7 per cent of 3,384 cases which were treated by antitoxine.

It is as yet too soon to state to what degree the frequency of paralytic sequelæ after diphtheria is to be affected by the antitoxine treatment; but the figures above given would indicate that the protective power of the serum over the nervous tissues is not so great as is seen elsewhere, and that unless administered very early it may have little or no influence.

Being one of the direct effects of the diphtheria toxine, neuritis is much more likely to follow severe than mild cases; however, its occurrence after some very mild attacks shows how great is the susceptibility of the nervous tissues to the action of this poison. Sometimes the throat symptoms have been entirely overlooked, and the development of paralysis has been the first thing to arouse a suspicion of previous diphtheria.

Time of Occurrence.—During the second week, and sometimes even during the latter part of the first week, the early paralysis occurs, affecting the palate, and in some cases the heart. The most frequent and most characteristic paralysis—that affecting the throat, eyes, extremities, heart, or respiration—begins at a later period, usually from one to three weeks after the throat has cleared off, and sometimes even later than this.

Extent and Distribution of the Paralysis.—Ross * gives the following statistics of 171 collected cases of diphtheritic paralysis: Palate affected in 128; eyes in 77, in 54 of which the muscles of accommodation were involved; lower extremities in 113; upper extremities in 60; trunk or neck in 58; muscles of respiration in 33. I do not think this represents the actual frequency of the different varieties so truly as do the American Pædiatric Society's figures, which give the forms of paralysis noted in a series of cases collected for another purpose. In 328 cases of paralysis, the variety was mentioned in 189: in 124 the throat was affected; in 22 the extremities; in 11 the eyes; in 5 the muscles of respiration; in 32 the heart; in 1 the neck only; in 8 the paralysis was "general."

Symptoms.—In the great majority of cases the throat is affected, and usually the paralysis is first noticed there. It may involve the palate alone, or the muscles of the pharynx or larynx in addition. The muscles of the extremities or of the eye are often next attacked. In severe cases there may also be involved the muscles of the trunk and neck, and sometimes the diaphragm. Cardiac paralysis not infrequently occurs where no other parts have been previously affected, but in nearly all the other forms, the throat symptoms precede. It is this which distinguishes diphtheritic paralysis from other forms of multiple neuritis. Whatever the extent or situation of the paralysis, the knee-jerk is nearly always lost. The symptoms in the extremities and the trunk do not differ from those of multiple neuritis from other causes. The throat paralysis shows itself by a nasal voice and by regurgitation of fluids through the nose, sometimes by difficulty in swallowing or the entrance of food into the larynx, owing to anæsthesia of the epiglottis and paralysis of the muscles of deglutition. There may be difficulty in protruding the tongue or in articulation. Paralysis of the vocal cords may cause hoarseness, aphonia, or attacks of spasmodic dyspnœa. Facial paralysis is very rare. On the part of the eye there is most frequently seen inability to read, owing to paralysis of the muscles of accommodation; there may be dilatation of the pupils, rarely strabismus or ptosis.

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* The Medical Chronicle, December, 1890.

Next to that of the throat, paralysis of the muscles of respiration and the heart are the most characteristic forms of diphtheritic neuritis. Respiratory paralysis may be due to involvement of the phrenic or the intercostal nerves, most frequently the former. Extensive paralysis of other parts—the throat, extremities, or trunk—usually precedes. The first warning is generally in the form of occasional attacks of dyspnœa, sometimes accompanied by cough. Gradually these attacks increase in frequency and severity. The voice is reduced to a whisper. As the diaphragm is usually affected, the breathing is entirely thoracic. The respiratory movements are rapid, but irregular, shallow, and ineffectual. There is cyanosis, also great subjective as well as objective dyspnœa. The anxiety, distress, and apprehension of the patient are sometimes terrible. There is a constant dread of impending suffocation, and the respiratory movements are continued only by the patient's constant efforts, otherwise they may cease altogether. After a few hours these severe symptoms may subside, to return after a short respite. There may be several such attacks during two or three days, in each of which death seems imminent. Unfortunately, this is the most frequent termination. Of thirty-three such cases collected by Ross, only eight recovered. Associated with these respiratory symptoms others may be present, indicating that the pneumogastric is involved. There may be attacks of abdominal pain, vomiting, and disturbance of the heart's action,—usually an irregular or intermittent pulse, which may be either unnaturally slow or very rapid. In many cases the heart continues to beat normally, even though the respiration is so much disturbed.

The premonitory symptoms of cardiac paralysis are an irregular or

intermittent pulse, often slow, bu
slightest exertion. It is always w
of the heart is feeble and may be re
there are marked pallor, coldness
anxiety, precordial distress, and pe
hours from the beginning of such sy
cases it may come suddenly witho
slight as to be overlooked. At suc
exertion, such as getting out of be
an effort as sitting up suddenly in
ment have at times produced it. I
heart paralysis is always due to a le
tant cause is toxic myocarditis. I
denly without premonition after so
ability the heart muscle which is m
the two conditions are associated.

Death from diphtheritic paraly
respiratory paralysis. Of one hund
rieties collected by Ross, forty-five w

Treatment.—Cases of paralysis
managed like others of multiple
paralysis feeding by a stomach tu
count of the danger of the entran
must in most cases be continued
passed either through the mouth or

The great mortality attending
shows how unsuccessful is treatment
there are instances where life may
cases of threatened heart paralysis,
is morphine, hypodermically ; this sh
in sufficient doses to keep the patie
ening symptoms are present. In s
combined with strychnine. The pa
not even being allowed to turn in be
eral reliance is upon strychnine use
to produce its physiological effects,
tory muscles, particularly the diaph
the attacks of respiratory failure and
cases patients may by these means be
disease.

FACIAL PA

Peripheral paralysis of the face occ
during delivery has already been descr

be considered here cases which arise from causes that operate at a later period. The facial nerve may be affected in any one of three situations,—after its exit from the cranium, in the bony canal, and within the cranium.

In the first situation, the principal cause of neuritis is exposure to cold (the "rheumatic" cases), but it occasionally occurs as a complication of mumps and disease of the lymph glands of this region. The nerve is affected just after it has escaped from the stylo-mastoid foramen, and all the branches given off beyond its exit are involved. There is paralysis of the muscles of the forehead, those about the eye, the cheek, nose, and mouth. The affected side of the face is smooth, there is inability to wrinkle the forehead, contract the eyebrows, close the eye completely, raise the nostril, whistle or blow. The mouth is drawn to the affected side (Fig. 140). If the paralysis is complete, there may be difficulty in drinking or in articulation. In partial paralysis the symptoms may not be noticeable while the face is at rest. There are no sensory symptoms. The electrical reactions resemble those of other forms of neuritis; there is diminution in the response to the faradic current, which is more or less marked according to the severity of the lesion, and there may be the reaction of degeneration.

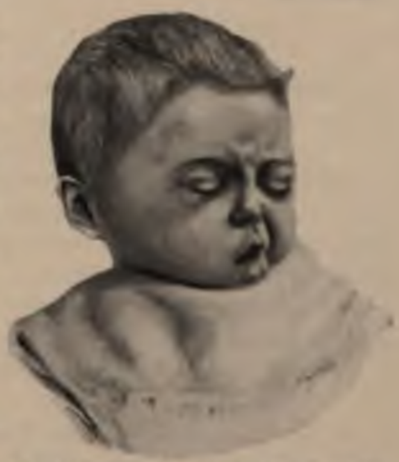

FIG. 140.—Facial paralysis from middle-ear disease in a child two and a half years old.

In the bony canal, the facial nerve is usually inflamed as a result of disease of the ear. In children this is much more frequent than from the causes just mentioned. While it is possible for it to occur in acute cases, it generally accompanies chronic otitis, especially where there is caries of the petrous bone. In addition to the paralysis there is present or there is a history of a discharge from the ear, and generally there is some deafness upon the side affected. The facial symptoms are usually the same as in the cases first described. However, when the nerve is affected between the stapedius and the geniculate ganglion, there is a disturbance of the sense of taste, and of the secretion of the saliva.

At the base of the brain the trunk of the nerve may be involved in cerebral tumour, basilar meningitis, and in fracture of the skull. In any of these conditions the auditory nerve also is likely to be affected.

Prognosis.—The result is greatly modified by the cause in the different cases. In those which are due to cold, spontaneous recovery usually occurs in the course of a few weeks or months. In those depend-

ing upon disease of the ear, the ou
there may be improvement, it is
manent. In the third group of c
symptoms, and the result depends

Diagnosis.—Facial paralysis is
separate the peripheral paralysis
pons, as in cases of ordinary hem
lower half of the face is affected, t
about the eye escaping, and the ele

Treatment.—This is essentially
In cases due to ear disease the prim
treatment.

SECTION VIII.

DISEASES OF THE BLOOD, LYMPH NODES, BONES, ETC.

CHAPTER I.

DISEASES OF THE BLOOD.

In general, the blood in infancy and childhood, as compared with that of adult life, is thinner and contains a larger proportion of water; it is also poorer in solids and has a lower specific gravity.

Specific Gravity.—This has no constant relation to the number of white or red corpuscles, but varies with the amount of hæmoglobin. The highest specific gravity is seen in the blood of the newly born, when, according to Lloyd-Jones, it is 1·066. During the first two weeks of life it sinks rapidly to its lowest point—1·048 to 1·052—where it remains until about the end of the second year; after this time it rises gradually until about puberty. The average specific gravity during childhood is 1·052 to 1·055 (Hock and Schlesinger).

Hæmoglobin.—The percentage of hæmoglobin is highest in the blood of the newly born, and falls rapidly during the first few days after birth. Throughout childhood it is considerably lower than in adult life. The hæmoglobin is lowest between the third month and the fifth year; after the fifth year it gradually increases up to puberty. According to Wydowitz, the usual range in infants and young children, as measured by the adult standard, is between 60 and 80 per cent, 60 per cent being the lowest limit in healthy children.

The cells of the blood are the red corpuscles or erythrocytes, and the white corpuscles or leucocytes.

Red Corpuscles.—The number of red corpuscles is highest in the newly born. At this time it is from 4,350,000 to 6,500,000 in each cubic millimetre. In infancy it is from 4,000,000 to 5,500,000; in later childhood, from 4,000,000 to 4,500,000 (Hayem). In size a much greater variation is seen in the red cells of the newly born than in those of older children and adults. In the blood of the fœtus there are present nucleated red corpuscles or erythroblasts (Plate XVI, A, 5, and B, 2). These diminish in number toward the end of pregnancy. They are always found in the blood of premature infants, but in infants born at term they are seen only

in small numbers and disappear a
presence is always pathological.

White Corpuscles.—Of these, fi
by Ehrlich :

1. *Lymphocytes or small monon*
resemble the red blood-cells in si
nucleus, which is so large as nearl
is non-granular. The source of t
glands.

2. *Large mononuclear cells.* T
ing variety, and have a single lar
margin of protoplasm surrounding i
blood ; they are derived from bone-

3. *Mononuclear transition form*
riety last mentioned, being similar i
an indentation on one side—the beg
further developed, these cells show tr
protoplasm, usually between the hor

4. *Polynuclear cells with neutro*
The nucleus is long, irregular, and
into several parts. The protoplasm
only by stains of neutral reaction. T
nuclear forms from which they are
than the red cells. They constitute
cytes in normal blood, and they are
leucocytosis. Forms 2, 3, and 4 pr
development of the same cells.*

5. *Eosinophile cells* (Plate XVI,
of the preceding forms. The protop
tions, which can be seen even befor
acid colors, especially with eosin, fr
derived. The granulations of these
the polynuclear neutrophile cells, w
generally two or three, do not stain s
have broken down, the resulting gran
of cocci. In normal blood these ce
the leucocytes.

The number of leucocytes in the
four times that of the adult, being on
metre (Hayem). The variations duri
12,000.

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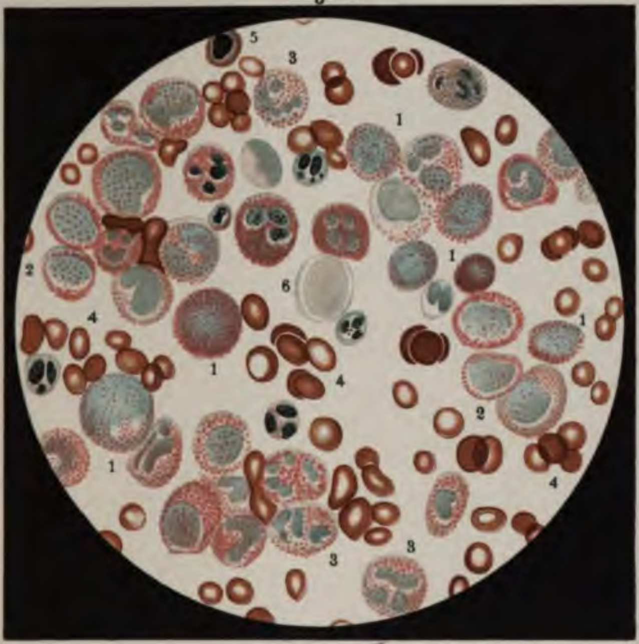
* In Uskow's classification these are deri
the lymphocyte, which is regarded as the you

PLATE XVI.

Fig. A.



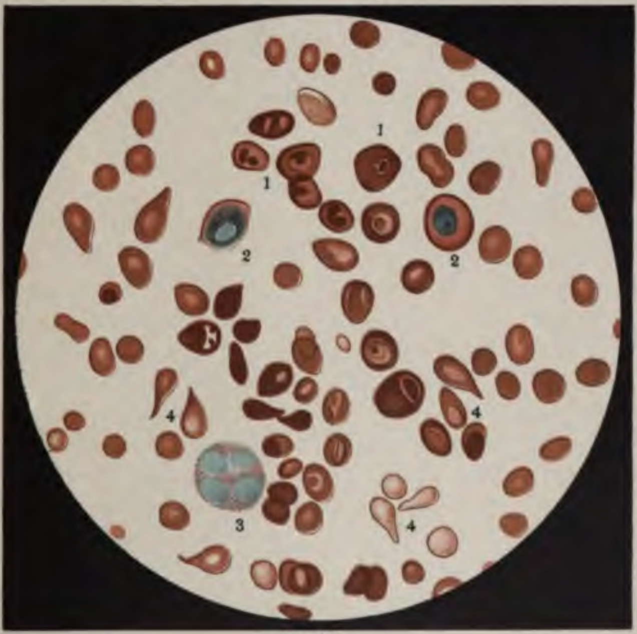


Fig.B.

A. The Blood in Leucæmia.

1, Eosinophile cells; 2, myelocytes; 3, polynuclear neutrophile cells; 4, red cells; 5, nucleated red cells; 6, lymphocytes.

B. Pernicious Anæmia.

1, Megaloblasts; 2, *nucleated* megaloblasts; [illegible] nuclear neutrophile cell; *4, poikilocytes.* [illegible] nti and Berggrün.)

The white cells may be said to be increased—i. e., leucocytosis exists—when their proportion to the red cells is greater than 1 to 200. It is not yet possible to state the exact percentages of the different varieties of white cells in normal blood. The polynuclear cells are, however, the most numerous, the lymphocytes next, and the eosinophile cells least frequent.

Before leaving the subject of the cells of the blood the so-called *blood-shadows* deserve a brief mention. These, according to Silbermann, are common in the blood of the newly born, but diminish with the age of the child. They contain no hæmoglobin. The existence of such cells is denied by some observers, who regard the appearance as due to the preparation of the specimen.

The following are the principal peculiarities in the blood of the newly born: The specific gravity and the hæmoglobin are high. The number of red cells is considerably higher than the average during childhood, and the same is true to a less degree of the leucocytes. The red cells vary much in size. They show less tendency to form rouleaux, although this is denied by some observers. Nucleated red cells, erythroblasts, are found for a day or two in small numbers, and the blood-shadows of Silbermann may be present.

It is only within the last few years that the diseases of the blood have been studied with anything like scientific accuracy. With our present knowledge it is difficult to classify accurately the various forms of anæmia. The essential character and the relation of the different forms to one another, are matters upon which there is still much difference of opinion among good observers. The classification here presented is that which has received the most general adoption, and may be accepted as a provisional one. With reference to the nicer points, most of the observations made prior to 1885 must be taken with considerable allowance.

SIMPLE ANÆMIA.

This consists in an impoverishment of the blood, especially the red cells, and a corresponding diminution in the specific gravity and in the amount of hæmoglobin. It is essentially a secondary anæmia, and occurs apart from disease of the blood-making organs. The important factors in its etiology are, first, an insufficient production of blood in consequence of deficient food or interference with the absorption of food, and, second, an increased drain or destruction of blood, as in exhausting diseases. Infancy and childhood are themselves strong predisposing causes of anæmia, on account of the great demands made upon the blood in the rapid growth of the body.

Etiology.—In certain cases anæmia may be congenital, as in infants born of delicate or anæmic parents, or where the mother during pregnancy has suffered from some serious disease, such as syphilis or nephritis. Acquired anæmia may come on at any period in infancy or childhood. The cause may be loss of blood, as in hæmorrhages of the newly born, epistaxis, purpura, scurvy, or hæmophilia. None of these are very common etiological factors. More frequently anæmia depends upon a loss of albumin of the blood, as in prolonged suppuration, chronic nephritis, large serous effusions occurring in the course of cardiac disease, certain forms of diarrhœa, and in malignant disease. Very frequently also it depends upon improper food, or disease of the organs of digestion or assimilation, as in the various forms of chronic diarrhœa, ileo-colitis, or chronic indigestion. These cases form a group sometimes classed as anæmia from inanition. In infancy, unhygienic surroundings, bad air, and close confinement to unhealthy apartments, are important factors in producing anæmia. In a large number of cases the anæmia is of toxic origin. In this group may be classed not only cases in which anæmia depends upon mineral poisons introduced into the body, such as mercury or chlorate of potassium, but also the poisons of all the infectious diseases, notably diphtheria. Febrile anæmia is not entirely due to toxic causes. It depends in part, no doubt, upon interference with digestion and assimilation. Anæmia may be due to parasites in the blood, the most striking illustration being the plasmodium malariæ, and it may occasionally arise from some forms of intestinal worms. The etiology of the anæmia accompanying certain constitutional diseases, such as rickets, tuberculosis, or rheumatism, is of a complex character.

Symptoms.—One of the most striking symptoms is the pallor of the skin and mucous membranes, although this is by no means an infallible guide to the degree of anæmia. Such children usually exhibit also symptoms of malnutrition: their muscles are soft and flabby; they are frequently thin and poorly nourished, but occasionally have an unusual amount of fat. They almost invariably suffer from digestive disturbances, such as coated tongue, poor appetite, and constipated bowels. The extremities are often cold, the pulse is rather weak and often slightly irregular. The heart-sounds are feeble, and anæmic murmurs may be heard either over the heart or the large vessels even in infancy, and occasionally a venous hum may be heard in the neck. In a certain number of cases of moderate severity there is found enlargement of the spleen, but rarely to the degree seen in leucæmia, or in the pseudo-leucæmia of infants. These cases were formerly classed separately as "splenic anæmia."

Nervous symptoms are frequent. Anæmic children are fretful, irritable, and often exhibit a degree of nervousness amounting almost to chorea. Others complain of headache and indefinite pains. Sleep is restless and disturbed, and often there is insomnia. The urine is scanty, frequently pale, and in many cases contains an excess of uric acid; there may be enuresis. Such children are easily fatigued, they frequently suffer from shortness of breath upon exercise, and occasionally have fainting attacks. They are especially prone to chronic catarrhal inflammations of the nose, pharynx, and bronchi. Epistaxis is not an uncommon symptom. Leucorrhœa may be present even in girls of three or four years. Dropsy is not infrequent in infants, but is rather more common in older children. In infancy, if anæmia comes on rapidly, as in the course of diarrhœal diseases, cerebral symptoms may be present.

The blood.—The changes in the blood depend much upon the grade of anæmia. In the milder forms there is only a moderate diminution in the specific gravity (1·042 to 1·046), in the hæmoglobin (50 to 55 per cent), and in the number of red cells, with very slight changes in their form or size. There is no increase in the leucocytes, although they are relatively more numerous on account of the reduction in the number of red corpuscles.

In more severe cases the hæmoglobin may be reduced to 30 or even 20 per cent, the specific gravity to 1·038 or lower, and the number of red cells to less than half the normal. In cases of such severity quite marked changes are usually present in their size and form. Microcytes, megalocytes, poikilocytes, and nuclear red cells (Plate XVI) may be present. The leucocytes in many cases show only a relative increase; in others they are actually increased, and may be twice as numerous as normal. Cases of this severity are to be considered, according to Monti and Berggrün, as intermediate between simple and pseudo-leucæmic anæmia.

Prognosis.—The course and termination of anæmia depend upon its cause. If this can be removed, steady improvement and recovery may be expected. In extreme cases death may take place, but rarely from the anæmia, usually from some complicating disease.

In making a prognosis there must be considered not only the general symptoms and the cause of the anæmia, but also the condition of the blood. If there is only a moderate reduction in the hæmoglobin and in the number of the red cells, with slight changes in their form and with no increase in the leucocytes, the prognosis is good. If the hæmoglobin is reduced below 30 per cent, if the number of red cells is less than half the normal, and marked changes in form are present, with or without great increase in the actual number of leucocytes, the prognosis is less favourable.

The treatment of all the forms of anæmia will be considered together at the close of the chapter.

CHLOROSIS.

Chlorosis is a primary or essential anæmia which usually occurs in young girls about the time of puberty. It is characterized by a peculiar greenish-yellow tint of the skin, and is not accompanied by emaciation. The changes in the blood consist in a very great reduction in the hæmoglobin without a corresponding diminution in the red corpuscles.

Etiology.—The exact cause of chlorosis is not yet fully understood.

The disease rarely occurs in male
in girls between the fourteenth a
blondes than in brunettes. Here
able number of the cases. Amo
occupations deleterious to health,
finement in ill-ventilated rooms;
disturbances, like grief, care, or
strain; and disorders of menstru
more frequently a result than a ca
attention to the fact that chlorosi
rowing of the aorta, sometimes ass
to reconcile this etiology with the
ment which is seen in most of t
the view that the chief cause of ch
absorption of toxic materials from
the disease has been lately urged w

Lesions.—Chlorosis is rarely fa
noted have been dilatation of the
ventricle, a small aorta, small uter
ulcer of the stomach. Under the
marked degree of fatty degenerati
of the inner coat of the blood-vesse

Symptoms.—The general sympt
simple anæmia. There are observ
palpitation, syncope, attacks of vert
rhœa, and almost invariably consti
being a peculiarity of these patie
articles. Instead of the usual pallo
green tint, from which the term " g
ally patches of pigmentation are see
heard in various situations, most fre
of the heart, and usually loudest ove
venous hum in the neck. In some
cardiac dilatation, especially of the
trophy of the left ventricle. The
feet is frequent, and sometimes there
there is fever. Nervous disturbance
tacks of migraine, supra-orbital ne
tions, and chorea, are common. Ul
as a complication.

The blood.—The blood changes i
red corpuscles may be normal or but
many cases but little variation from
there are microcytes, megalocytes, a

have an unusually pale colour. The number of leucocytes is normal or very slightly increased. The hæmoglobin is uniformly reduced, usually to a great degree. Osler gives 44·1 per cent as the average in forty cases.

Prognosis.—The course of the disease is essentially a chronic one, often lasting for a year. Relapses are quite frequent. Except when dependent upon congenital malformations of the heart and blood-vessels, these cases regularly recover when proper treatment can be carried out. A small number prove fatal by the development of tuberculosis or the occurrence of gastric ulcer.

Diagnosis.—The diagnosis is in most cases easily made from the etiology, the functional derangement of the heart, the colour of the skin, and a positive diagnosis always by an examination of the blood.

PSEUDO-LEUCÆMIC ANÆMIA OF INFANCY.

This form of anæmia was first described by Von Jaksch in 1889, and is believed to be peculiar to infants and young children. It is characterized by marked leucocytosis, marked reduction in the number of red corpuscles and in the hæmoglobin, a great enlargement of the spleen, and sometimes a moderate enlargement of the liver and the lymphatic glands. This disease is not to be confounded with the pseudo-leucæmia of adults, or Hodgkin's disease, which is purely a disease of the lymphatic glands with secondary anæmia, but without any leucocytosis.

Etiology.—Of the cases thus far recorded the majority have been between the ages of seven and twelve months, the oldest being at three and a half years. Of twenty cases collected by Monti and Berggrün,* sixteen showed evidences of rickets and one was syphilitic. Pseudo-leucæmia, however, appears to occur in this disease only when the splenic enlargement has reached a certain grade. The exact cause of the disease is still unknown, and its essential nature is a matter of some doubt. Monti believes that it may develop from the more severe cases of anæmia which are accompanied by leucocytosis, as he has observed this condition before the development of pseudo-leucæmia and during its subsidence. The disease may terminate in ordinary leucæmia, and possibly in pernicious anæmia.

Lesions.—The most characteristic change is found in the spleen. This organ is very much enlarged, often forming an abdominal tumour, which extends as low as the crest of the ilium and as far forward as the umbilicus. It is firm, hard, the surface appears somewhat wrinkled, and there may be evidences of perisplenitis. The microscope shows an increase of cellular elements, a few cells containing hæmoglobin (Luzet).† Enlargement of the liver is less constant, it being normal in more than half the cases. There is no relation between the size of the spleen and that of the liver.

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* Die chronische Anämie im Kindesalter, Leipsic, 1892.

† Thèse, Paris, 1891.

The hepatic cells are unchanged. Enlargement of the lymph glands has been noted in about half the reported cases, the swelling affecting the cervical, axillary, or inguinal glands; but it is rarely great. A moist appearance and a diffuse redness of the bone-marrow have been described by Luzet, the changes being usually most marked about the epiphyses.

Symptoms.—*The blood.*—The number of reported cases is as yet too small to make positive statements possible upon all points. The most constant features noted thus far are the following:

The specific gravity is lowered, the usual range being between 1·035 and 1·044. The reduction of the hæmoglobin is very great; in many of the cases it has been as low as 30 per cent, and in a few below 25 per cent. The leucocytes are increased in number, this being one of the striking features of the disease. In ordinary cases the proportion of leucocytes to red corpuscles is 1 to 100 or 1 to 75. In severe cases the proportion may be as high as 1 to 20 or even as 1 to 12. All the usual varieties of leucocytes are seen, the proportions of these varying much in the different cases. The red corpuscles are reduced in number in proportion to the severity of the disease, usually to from 65 to 75 per cent, but they may be as low as 35 or even 25 per cent. In six of twenty cases the actual number was below 1,600,000 (Monti and Berggrün). More characteristic than any of the above features are the changes in the appearance of the red cells. Very marked inequality in their size and shape is seen in most of the cases. Many microcytes are present; also great numbers of nuclear red blood-cells (erythroblasts), normoblasts, and megaloblasts with dividing nuclei. These are seen to some degree in other forms of anæmia, particularly in the pernicious variety and in the severe types of simple anæmia, but they are more abundant in pseudo-leucæmia. The larger the proportion in which they are present the worse the prognosis. Finally, there is occasionally seen a division of the nuclei of the red cells (karyokinesis), regarded by some as characteristic of the disease, although this is not admitted by all.

The general symptoms of the disease develop slowly and with the usual signs of anæmia. In some cases the infants continue to be plump and well nourished. Pallor is usually very marked. Enlargement of the spleen is so great that it can hardly be overlooked if the abdomen is examined. The glandular enlargements are not marked, and in many cases are wanting altogether.

The course of the disease is essentially chronic. Cases have been seen in which pseudo-leucæmia developed from an ordinary severe simple anæmia in the course of a few weeks. The symptoms and blood changes generally come on slowly in the course of weeks or months, and sometimes remain nearly stationary for as long a period as several months, and then slowly improve. In other cases they grow gradually worse, and the changes in the blood come to be the same as in ordinary leucæmia. Some observers are inclined to believe that the disease is really an early stage of leucæmia, which does not reach its full development because the children succumb too early. In the cases going on to recovery, there is noticed improvement in the general symptoms coincident with a diminution in the size of the spleen, a reduction in the number of leucocytes, an increase in the red corpuscles, the hæmoglobin, and the specific gravity, and a gradual disappearance of the erythroblasts.

Prognosis.—In Monti's list of twenty cases four proved fatal; one recovered, in which the proportion of leucocytes to the red corpuscles had been 1 to 12. The prognosis should always be guarded, for, although improvement may take place, patients are very apt to be carried off by intercurrent disease.

Diagnosis.—The diagnosis is to be made from simple anæmia with leucocytosis, and from leucæmia. In simple anæmia the leucocytosis is not so great, and it is not accompanied by such a degree of splenic enlargement. In leucæmia the reduction in the red cells and in the hæmoglobin is very rarely as great as in pseudo-leucæmia.

PERNICIOUS ANÆMIA.

This is the most severe form of anæmia known. Its cause and essential nature are as yet very imperfectly understood. It is characterized by quite uniform blood changes and by the general symptoms of a very marked anæmia, and it tends to go on from bad to worse, terminating fatally in the great proportion of cases.

Etiology.—Pernicious anæmia is a rare disease in childhood, and especially rare in infancy. In the cases which have been observed in early life the following etiological factors have been noted: It has been associated with hereditary syphilis and with severe rickets, especially when accompanied by a marked enlargement of the spleen. It has followed other diseases, especially grave disturbances of nutrition. Sometimes simple anæmia, when severe and of long standing, has gradually developed into the pernicious type. In a few instances parasites, particularly tapeworms, have been the cause. Pernicious anæmia has in some instances occurred in patients where no cause whatever could be assigned.

Many theories have been advanced in explanation of pernicious anæmia. The one which at present appears to have most in its favour is that the disease consists in a great destruction of the red blood-cells, particularly in the liver, and that this is brought about through the agency of some poison or poisons taken up from the intestine by the portal circulation.* This has been advanced by Hunter and others in explanation of the peculiar deposit of iron found in the hepatic cells.

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* For fuller discussion of this theory of pernicious anæmia, see Griffith and Burr, the Medical News, October 17, 1891.

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Diagnosis.—This is to be made f
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corpuscles are the great reduction in their number, the unequal distribution of hæmoglobin, the marked irregularities in form and shape, and the presence of many large nuclear forms; with reference to the leucocytes, a reduction in number proportionate to that of the red cells.

Treatment of the Different Forms of Anæmia.—In *secondary anæmia* the thing of the first importance is to discover and treat the primary condition upon which the anæmia depends. In infancy, special attention should be given to diet and hygiene, particularly with reference to an abundant supply of fresh air. The whole manner of life of these patients must be carefully studied and managed according to the directions laid down in the chapter upon Malnutrition, with which condition, especially in infancy, a very large number of these cases are associated. The general treatment referred to is often more important than the administration of the preparations of iron, which, however, should never be omitted.

The preparations of iron available for infants are the Drees's albuminate, the pepto-manganate (Gude), the bitter wine, the malate and the citrate. The dose should be regulated according to the age of the child. Older children may take the same preparations as adults, especially Blaud's pills. Much benefit is seen from combining arsenic with iron, or from alternating the two. Arsenic should be used in conjunction with iron in every anæmia in which there is enlargement of the spleen or lymphatic glands. In addition to these remedies, cod-liver oil should be given throughout the entire cold season.

In *chlorosis* more decided results are seen from the use of iron than in any other form of anæmia. Blaud's pills are here the favourite method of administration, and are advantageously combined with small doses of nux vomica and aloin to overcome the tendency to constipation. Arsenic is useful in these cases also. Great benefit in chlorosis results from change of air and change of scene, thus removing the patient from all sources of nervous excitement or disturbance. The general condition, diet, and habits of life should also receive careful attention, particularly the condition of the bowels. The use of oxygen is a valuable adjuvant in the treatment of cases not yielding to iron alone. It is important that the administration of iron should be continued for several months after the disappearance of all symptoms, on account of the tendency to relapses.

In the *pseudo-leucæmic anæmia* of infants, arsenic is decidedly the most valuable drug, but should be given in combination with iron. Fowler's solution is the best preparation for infants; the dose should rarely be more than one drop, which should be repeated four or five times daily after feeding, and continued for a long time. The general treatment of these patients is the same as in cases of simple anæmia. When rickets is present cod-liver oil and phosphorus should be added.

In *pernicious anæmia*, arsenic offers a much better prospect of improvement than iron. Beginning with small doses, the amount should be gradually increased up to the point of tolerance, very much as in cases of chorea.

In every case of anæmia the most careful attention should be given to the general condition, particularly guarding against exposure to cold and dampness. The feeble circulation of these patients renders them peculiarly susceptible. Caution should also be given against much muscular exercise. With a severe grade of anæmia very active exercise should be prohibited, and many of these patients do best when complete rest in bed, either for the entire time or for a considerable part of each day, is insisted upon. This applies to children of all ages.

LEUCÆMIA.

This is a disease in which the essential feature is a great increase in the number of leucocytes, with a moderate reduction in the number of red corpuscles, and the presence in the blood of cellular forms not found in other diseases.

Etiology.—Leucæmia is a rare disease in childhood, but has been seen even in early infancy. Its greater frequency in males holds good even in childhood. In a small number of cases heredity seems of some importance as an etiological factor. Leucæmia may follow syphilis, rickets, malaria, or even simple anæmia, or it may occur as a primary disease in children previously healthy. In the great majority of cases the cause is unknown.

Lesions.—The essential lesions of leucæmia are found in the spleen, the lymphatic glands, and the bone-marrow. In rare cases the most important changes are in the lymphatic glands, giving rise to the *lymphatic* form of leucæmia. In such cases the changes in the spleen or marrow may be slight or absent. Changes in the spleen and marrow are, however, usually associated, giving rise to what is known as the *spleno-myelogenous* form of the disease, which is the most frequent variety. The spleen is usually enormously enlarged, sometimes filling half the abdominal cavity. In the early stage it is soft, vascular, and of a dark-red colour; in the late stages it is firm and hard, and usually deeply fissured at its margin. There may be perisplenitis. On section, light-gray patches of lymphoid tissue may be seen scattered throughout the organ, and in some instances there may be wedge-shaped infarctions. The microscope shows thickening of the trabeculæ and deposits of lymphoid tissue, especially about the arteries. The bone-marrow is of a yellowish-green or dark-brown colour, and shows immense numbers of nuclear red corpuscles in all stages of development, and many cells corresponding to the myelocytes found in the blood. The lymphatic glands, when they are involved, are not so uniformly enlarged as is the spleen. Any of the external glands of the body may be affected, the cervical, axillary, and the inguinal, or the mesenteric, tracheo-bronchial, the tonsils, and even the lymph nodules of the small and large intestines. The changes in the glands are generally those of a simple hyperplasia. The liver is enlarged in very many of the cases, chiefly from an infiltration with lymphoid tissue, which may be diffuse or may occur in patches. Less frequently similar lymphoid masses are seen in other organs.

Symptoms.—*The blood* (Plate XVI, A).—In gross appearance the blood is paler than normal, and the clot of a yellowish-green colour. The fibrin is usually increased. Both the specific gravity and the hæmoglobin are diminished, the latter often being reduced to 25 per cent. The most important change is in the leucocytes. These are enormously increased, the proportion often being one to five of the red, and sometimes even one to two.

In the spleno-myelogenous variety the predominant form is the large mononuclear cells with neutrophile granules, and are known as *myelocytes* (A, 2). The presence of the neutrophile granules distinguishes them from other mononuclear cells. The source of these is the bone-marrow, and they are not found in the lymphatic variety of the disease. In addition there is often an increase in the eosinophile cells (A, 1). The lymphocytes are relatively diminished; the percentage of the polynuclear neutrophile cells (A, 3) is normal or diminished. The red corpuscles are moderately reduced in number, usually to from 30 to 50 per cent, and exhibit the irregularities in form and shape seen in other varieties of anæmia. There are also nuclear red-corpuscles present whose nuclei are sometimes undergoing division.

In the lymphatic form of the disease, the blood shows quite marked differences. The increase in the leucocytes is not so great, and is due solely to the increase in the number of lymphocytes, the myelocytes being absent. Occasionally both forms of the disease may be combined.

The other symptoms of leucæmia in children resemble those in adults, with the difference that, as a rule, the progress of the disease is much more rapid in early life. In most of the cases the early symptoms are latent. A sudden and alarming hæmorrhage is sometimes the first thing to call attention to the serious condition. In other cases there are only the symptoms of general weakness and anæmia. Sometimes the splenic tumour or the enlargement of the lymphatic glands is first noticed. In the early part of the disease, the usual symptoms of anæmia are present,—digestive disturbances, shortness of breath, weak and rapid pulse. Hæmorrhages may occur as an early or late symptom; they are most frequently from the nose, but severe hæmorrhages may occur from the stomach, the mouth, the intestines, or there may be ecchymoses upon the skin. The enlargement of the spleen may be sufficiently marked to form an abdominal tumour, so as to attract the attention even of the parents. The swelling of the liver is not so great. The lymphatic glands are enlarged only to a moderate degree, and in many cases this symptom is absent altogether. They are painless, movable, and usually several groups are affected.

The late symptoms are dropsy of the feet or general anasarca, hæmorrhages, diarrhœa, headaches, general weakness, and attacks of fainting. Fever is quite constant in the late stages of the disease, and the temperature may be from 101° to 103° F. The urine may contain albumin and casts. Vision is sometimes disturbed by the formation of leucæmic plaques in the retina. It is rare that there are any symptoms referable to the bones, although expansion and tenderness of the flat bones have been observed.

Course and Prognosis.—The course of leucæmia is chronic, and in most cases slowly progressive, but not always so. The prognosis is very bad, the great proportion of the cases in children proving fatal within a year from the first symptoms, in infancy sometimes in two or three months. There has been described by Epstein and others an acute form of the disease, proving fatal in a few weeks. The usual causes of death are exhaustion, hæmorrhages, and broncho-pneumonia.

Diagnosis.—This, in children, has to be made chiefly from simple anæmia with leucocytosis, and pseudo-leucæmic anæmia. Without a blood examination this is impossible. Reliance is to be placed upon the enormous increase in the leucocytes, and especially upon the presence of myelocytes. In the other diseases mentioned there is simply an increase in the usual varieties of leucocytes; different forms may predominate in different cases, but no new ones are present.

Treatment.—The general treatment of leucæmia should be the same as that of anæmia. Of the drugs now in use, arsenic has altogether the most testimony in its favour. It must be given in large doses and for a long period. Next to this in value come iron and cod-liver oil. Leucæmia, however, is in most instances very little influenced by treatment. The reported cures must be taken with some allowance, for most of these were published before the time when leucæmia was sharply differentiated from simple anæmia with leucocytosis and from the pseudo-leucæmic anæmia of infancy.

HÆMOPHILIA.

Hæmophilia is an hereditary disease, in which there is a tendency to profuse or even uncontrollable bleeding from slight wounds, or sometimes even spontaneously. In many cases there is associated an inflammation of the joints. Persons so affected are known as "bleeders."

Etiology.—The hereditary tendency of the disease is very strongly marked, and it has often been traced through seven or eight generations. Males are much more frequently affected than females, the proportion being about twelve to one. In the matter of inheritance, the disease is most often transmitted through the mother, who may, however, herself escape.

Patients suffering from hæmophilia have nothing else about them that is abnormal. The exact nature of the disease is unknown. It has no connection with either purpura or scurvy. Although generally classed among the diseases of the blood, it has not been established that there are any constant changes either in the blood or in the blood-vessels.

Symptoms.—The first manifestations of hæmophilia are not often seen before the second year. The hæmorrhages of the newly born have no relation to this condition. The discovery of the disease is generally quite accidental. The first hæmorrhage may be traumatic or spontaneous. In traumatic hæmorrhages there may be very severe bleeding after so slight a wound as the drawing of a tooth; sometimes a large hæmatoma forms between the muscles as the result of a moderate contusion.

The following is the relative frequency of spontaneous hæmorrhages in 334 cases collected by Grandidier: bleeding from the nose in 169, mouth in 43, intestines in 36, stomach in 15, urethra in 16, lungs in 17. There may be hæmorrhage from the skin or from any mucous membrane of the body. The attacks of spontaneous hæmorrhage are often periodical, and may be accompanied by arthritic symptoms resembling rheumatism. The severity of the hæmorrhages varies much in the different cases. From a slight wound a patient may bleed until he is exsanguinated, and even until death occurs. Such a result from the first hæmorrhage, however, is rare. In some cases the disposition to bleed is outgrown in later life. Grandidier states that, of 152 boys, over one half died before reaching the seventh year. It is striking that when the disease affects females there is no tendency to excessive bleeding at menstruation or parturition.

Treatment.—The indications at the time of bleeding are, to arrest the hæmorrhage by the use of the ordinary surgical means—compression, styptics, etc.—and the nares should be plugged for severe epistaxis. Little benefit is to be expected from drugs. In convalescence after attacks of hæmorrhage, iron and general tonics should be given. In all patients who are bleeders everything which might by any means excite hæmorrhage should be avoided. Marriage should be discouraged in girls who inherit the disease.

PURPURA.

The term purpura is used to designate a condition in which there is a tendency to spontaneous hæmorrhages beneath the skin, from the various mucous membranes, and in some cases into the internal organs. The term *purpura simplex* is applied to those cases in which the hæmorrhages are limited to the skin; *purpura hæmorrhagica* to those in which there is in addition bleeding from the mucous membranes or visceral hæmorrhages. It is impossible to draw a line sharply between these two classes of cases, as the chief difference between them seems to be one of degree. Purpura is sometimes known as *morbus maculosus* or as *Werlhof's disease.*

Symptomatic Purpura.—This occurs in quite a variety of conditions, the hæmorrhages generally being limited to the skin, but not always so. These cases may be grouped in the following classes:

1. *Infectious.*—This form of purpura is very constantly seen in malignant endocarditis, in the hæmorrhagic forms of the various eruptive fevers—measles, scarlet fever, variola, vaccinia, and typhus—also in epidemic meningitis and occasionally in diphtheria, pyæmia, and septicæmia. The occurrence of hæmorrhages in these cases appears to depend upon an altered condition of the blood, which is a direct result of the infection. In most of the diseases mentioned it is a bad prognostic sign, as it indicates a severe form of the disease, but it requires no special treatment.

2. *Cachectic.*—Purpura occurs late in the course of many protracted and exhausting diseases, especially in infancy. It is most frequently met with in broncho-pneumonia, empyema, tuberculosis, ileo-colitis, in both the tuberculous and the simple forms of meningitis, and in malignant disease. It also occurs from apparently similar causes in several of the diseases of the blood, particularly in leucæmia and pernicious anæmia, and occasionally it is seen in chronic nephritis and in cardiac disease. In most cases of cachectic purpura the hæmorrhagic spots are not very abundant, and occur either upon the abdomen or the lower extremities. They are usually small, but when once they have appeared new spots usually continue to come until death. This form is quite common in hospital practice, and when occurring in the course of the diseases mentioned it is almost invariably indicative of a fatal result. Cachectic purpura is usually limited to the skin, hæmorrhages from the mucous membranes being infrequent and visceral hæmorrhages very rare. The condition is undoubtedly dependent upon a deterioration in the blood possibly also upon the condition of the minute blood-vessels themselves. Purpura adds nothing to the severity of the original disease, but is an indication of how extensive the blood changes are. It requires no special treatment.

3. *Toxic.*—Certain drugs, such as phosphorus, quinine, potassium chlorate and sometimes others, may produce hæmorrhages when long continued or in large doses. The hæmorrhage of jaundice may also be considered in this group. All these conditions are extremely rare in childhood.

4. *Mechanical* hæmorrhages, such as those occurring in pertussis or epilepsy, are sometimes classed with purpura. In convalescence from protracted illness there are sometimes seen, when patients first stand or walk, purpuric spots on the lower extremities. I have seen it after diphtheria. It may occur after prolonged confinement of a limb in bandages or splints.

In both these cases the cause is partly mechanical and partly due to the weakened condition of the blood-vessels.

5. *Neurotic.*—These cases are occasionally seen in diseases of the spinal cord and sometimes in hysteria in young adults, but very rarely in children.

Primary Purpura.—This occurs in children of all ages, being not uncommon in infancy. Hæmorrhages of the newly born have not generally been included in this class, although there are some reasons why they might well be. The age at which primary purpura is most frequently seen is from two to ten years. The sexes are about equally affected; of Steffen's 56 cases, 27 were males and 29 females. The disease may occur in children who are cachectic, rachitic, or anæmic, and in those whose surroundings are poor, but it has not, like scurvy, any close relation to diet. It may follow any acute disease, being associated most frequently with derangements of the stomach and bowels. Quite frequently the disease develops abruptly, without any assignable cause, in children previously healthy. It is not contagious. Epidemics of purpura have been reported, but these are somewhat doubtful, as they were recorded before this disease was sharply differentiated from scurvy. The association of purpura with rheumatism will be considered later.

Lesions.—The external hæmorrhages may occur upon any part of the body. There are smaller or larger ecchymoses or an infiltration of the tissues with blood, which undergoes gradual absorption with the usual changes. With the hæmorrhages, various forms of inflammation of the skin may be associated, especially erythema and urticaria, with sometimes more or less œdema. Free bleeding from the skin is very rare. Hæmorrhages from the mucous membranes are more frequent, because of the feebler resistance of the tissues. There are seen ecchymoses upon the visible mucous membranes which resemble those upon the skin. At autopsy they are occasionally seen in the trachea or bronchi, but more often in the digestive tract. The stomach and intestines may contain dark, clotted blood, bloody mucus, or even fluid blood. In the colon, and occasionally in the small intestine, ulcers may be found; but they are rarely if ever seen in the stomach. They may be superficial or deep, and have even been known to cause perforation. The deep ulcers have generally been attributed to thrombosis. Ulcers are often absent where intestinal hæmorrhage has been severe. Associated with these lesions there may be inflammatory changes in the mucous membrane of the stomach and intestines.

Intracranial hæmorrhages are rare, and those which occur are usually meningeal. These may be extensive and sufficient to cause severe symptoms. In 1893 a case occurred in the New York Infant Asylum in an infant six months old, with an extensive meningeal hæmorrhage covering a large part of the brain. In Steffen's paper several such cases are mentioned.

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true of most of the primary cases. At the present time the exact pathology of purpura is unknown. There are, no doubt, now included under this term, several diseases quite distinct from one another.

The clinical types.—1. The ordinary form.—In the mild cases the hæmorrhage is confined to the skin (purpura simplex), or it is accompanied by slight bleeding from the mucous membranes. There is usually some general indisposition of an indefinite character for a day or two before the purpuric spots are noticed; most frequently a disturbance of digestion with vomiting, diarrhœa, and sometimes slight fever. The hæmorrhages appear as small petechiæ, varying in size from a pin's head to a pea; usually first upon the lower extremities, but sometimes first upon the trunk, the face, or the upper extremities. There may be only a few widely scattered spots or the body may be covered. The colour is first a bright red, then purple, gradually fading in the course of a few days. New spots come as the old ones disappear, so that the amount of eruption may not diminish; often the spots come out in distinct crops. They do not disappear upon pressure.

The course of these cases is generally favourable, recovery taking place in from one to four weeks under the influence of general tonic treatment. Relapses are, however, very frequent, and such attacks may come at intervals of a few weeks or months for a considerable period. One must be guarded in giving an absolutely favourable prognosis even in cases of such severity, for it occasionally happens that in a patient, who for several days has had symptoms of mild purpura, there suddenly develop those of the most severe type with a rapidly fatal termination.

2. The severe form.—Such cases are characterized by hæmorrhages from the mucous membranes (purpura hæmorrhagica) from the outset. These may even appear before the spots upon the skin. The relative intensity of the two varies much in different cases. In severe attacks the petechial spots are more likely to appear suddenly, and large ecchymoses, varying in size from a pea to the palm of the hand, are more frequent. There may be bleeding from the nose, gums, mouth, or pharynx, and ecchymoses may be seen upon these mucous membranes, also upon the conjunctivæ. Vomiting of blood and bloody discharges from the bowels are quite frequent symptoms. The urine may contain enough blood to give it a bright-red colour. Less frequently there are seen hæmorrhages of the retina or choroid and from the female genitals. In one of my own cases there was almost continuous bleeding from one ear. Hæmoptysis and free bleeding from the skin are both rare. Cutaneous ecchymoses are increased by slight injuries, such as the pressure from a bandage or from scratching. Epistaxis may be copious enough to necessitate plugging of the nares. The amount of blood vomited is not often large; its source may be the stomach, the mouth or the pharynx. The blood in the stools is usually dark coloured, but there may be some bright-red blood even when there

are no ulcers present. In one of my cases so much blood was lost by the bowels as to produce the symptoms of a very marked cerebral anæmia. In certain cases the gastro-intestinal symptoms are very prominent, and there may be slight icterus. The discharge of blood from the stomach or intestine may be accompanied by very severe attacks of colic and tenesmus. In some of these cases there are pains and slight swelling of the joints. Renal symptoms are generally present. These attacks of pain with purpura and the discharge of blood, may come on paroxysmally every few days for a period of several weeks. They have been ascribed to thrombosis of the intestinal vessels. This is sometimes known as "Henoch's purpura."

Constitutional symptoms are present in most of the severe cases. There is usually fever, from 101° to 103° F., and sufficient prostration to keep the patient in bed. If the amount of blood lost is large, there are the usual symptoms of severe anæmia,—pallor, weak pulse, cold extremities, fainting attacks, and functional heart murmurs. The loss of blood may be sufficient to cause death, particularly in infants. Cerebral symptoms may depend upon anæmia or upon meningeal hæmorrhage. They are not frequent in this form of the disease. Œdema, especially of the face and feet, may exist without albuminuria, and albuminuria may be present in cases in which there is no renal hæmorrhage. The amount of albumin is generally small, and casts are rare.

In some of the cases beginning with severe general symptoms, and occasionally when the onset is mild, the patients after a few days pass into a typhoid condition with low delirium, great prostration, weak and irregular pulse, dry, cracked tongue, and high temperature. Such cases are almost always fatal. They are not to be confounded with ordinary typhoid fever complicated by purpura.

The course varies much in the different cases. It lasts from one to six weeks, the symptoms slowly subsiding, but often showing a strong tendency to recurrence. The prognosis depends upon the age of the patient, the extent of the hæmorrhage, and the presence or absence of septic symptoms.

3. The hyper-acute form (purpura fulminans).—This is a rare form, especially in young children. Its development is usually sudden with a chill, vomiting, marked prostration, and high temperature. The purpuric spots come out with great rapidity, and in the course of a few hours or a day they may be very extensive. In addition to the ordinary subcutaneous hæmorrhages, bloody vesicles may form upon the skin. In many cases the hæmorrhages are limited to the skin, the mucous membrane and the viscera escaping altogether. There is no tendency to gangrene. Cerebral symptoms are invariably present and usually prominent; there may be delirium, dulness, stupor, and finally coma. The spleen is apt to be enlarged. The urine is nearly always albuminous. This form of purpura

has all the characteristics of a general infectious disease, and it is almost invariably fatal. But little is as yet definitely known regarding its cause or its relation to the other forms.

4. The gangrenous form.—Sloughing is not common in purpura, but it is most often seen in the mucous membranes. Osler refers to two cases affecting the uvula. I once saw a slough which caused perforation of the soft palate. Wickham Legg reports a case with gangrene of the prepuce. The deep ulcers of the intestine which are seen in some of the severe cases are apparently necrotic rather than inflammatory. Gangrene of the skin is even less frequent, although cases have been reported even in young children. Charron's case was only three years old, and several others in children are collected in Gimard's monograph upon this subject. The gangrene may involve the skin only, or the subcutaneous tissues and even the muscles. It has been seen upon the upper and lower extremities and even upon the face, and may extend over quite a large surface. In some of the milder forms of purpura, gangrene results from some slight injury, such as a blow, the pressure from a bandage, or in the nose, from the pressure of a tampon. In the gangrenous cases, all the symptoms are usually severe and indicate extensive blood alteration. They are almost invariably fatal. Those in which the sloughing is confined to small areas of the mucous membrane of the mouth often recover.

5. The rheumatic form.—Rheumatic purpura (peliosis rheumatica) is applied to cases, not so common in children as in older patients, in which subcutaneous hæmorrhages, and sometimes bleeding from the mucous membranes, are associated with painful joint swellings. These are to be regarded as cases of rheumatism complicated by purpura. The joints most frequently affected are the knee and the ankle. The arthritic symptoms are usually less severe than in attacks of acute rheumatism. There may be present erythema exudativa or erythema nodosum or urticaria. Usually there are throat symptoms and fever, and frequently œdema of the face and eyelids with albuminuria. The spleen may be enlarged. The usual duration is from one to three weeks, and although relapses may occur, the cases usually recover.

Joint symptoms, particularly articular pains, are not infrequent in the course of milder attacks of purpura without the febrile symptoms mentioned. In severe cases extravasations of blood have been reported as occurring in the tissues about the joints, and even in the joints themselves, these being cases of true arthritic purpura. It is probable that, in the past, some cases of scurvy have been included in this category.

Diagnosis.—The rapid acute cases may be confounded with the hæmorrhagic forms of the various eruptive fevers. The ordinary subacute or passive forms are chiefly to be differentiated from scurvy. The diagnosis is not difficult and the mistake need not be made if the essential features of scurvy are borne in mind,—its dietetic cause, bleeding gums, hyperæs-

thesia, and deep rather than sub
ally near the joints.

Prognosis.—This depends ver
Of 128 cases of all varieties occu
there were 40 deaths. In 12 case
Gimard, there were 3 deaths and
fatal; cases of purpura hæmorrha
rile symptoms are present. The
and purpura fulminans are alm
relapses exists in all varieties.

Treatment.—The treatment of
erence to the cause of the disease
usually recover promptly under a to
cases require confinement in bed,
ure and even the slightest injury o
do not seem to influence the cou
uniform way. Those most freq
melis, aromatic sulphuric acid,
acid. Iron should be deferred
Whether or not it is true, as clai
eases are related to scurvy, the stri
from the use of fresh fruit and ve
purpura. In some cases very decid
the acute stage, but more particula
and gangrenous cases, little can be
Surgical means of arresting the ha
and arsenic and alcoholic stimula
convalescence.

CHAP

DISEASES OF THE LYMPH

LYMP

It is characteristic of infancy and
or the lymph nodes, as they are now
out the body are prone to swelling a
belongs to all children, in certain in
a place as a distinct diathesis. It wa
festations of "scrofula" or "strum
manifestations formerly classed as "
tuberculosis, makes it undesirable to

tive of conditions now known to be often due to other causes besides inherited tuberculosis. The term *lymphatism* has been used by Potain and other French writers, and in this country by Bosworth, to designate this condition.

In stout, robust children, infectious processes of the nose, pharynx, or bronchi, cause acute swelling of the lymph nodes in the neighbourhood, but these rapidly subside when the cause is removed. In others, in whom a certain constitutional condition exists, the process in the mucous membrane is likely to be protracted, and the enlargement of the lymphatic glands once started continues even after the primary cause has subsided; or, diminishing for a time, it increases again with every new exciting cause until permanent enlargement may be produced.

I shall use the term lymphatism in the sense indicated,—viz., to designate an exaggerated susceptibility of the lymphoid tissue, a constitutional condition in which any inflammation of the mucous membranes or skin sets up hyperplasia in the lymph nodes with which these parts are connected, which is out of proportion to the exciting cause and which continues after the cause has ceased to operate. Besides, there must be included in this category, children who at birth have an excessive development of lymphoid tissue, seen particularly in the region of the throat in the form of enlarged tonsils, adenoid vegetations of the pharynx, etc.

Lymphatism may be inherited or acquired. The influence of heredity is too often seen to be passed over as a coincidence. Frequently the parents, when children, suffered from the same condition, and very often every member of a large family of children is affected. This may be the case in those who are in other respects healthy, who have been reared amid good surroundings, and in whom no evidence of any other constitutional disease can be found. Any disease in the parents in consequence of which children are born with tissues having less than normal resistance, may be regarded in the light of a remote cause. As such may be mentioned gout, rheumatism, alcoholism, syphilis, or tuberculosis, the child under these conditions inheriting not the disease, but, so to speak, its consequences.

Among the causes operating after birth to produce lymphatism, the surroundings of the child are of the first importance. It is seen to perfection in children reared in institutions; it is also frequent in crowded tenements and in cities rather than in the country. Anything which produces malnutrition or lowers the general vitality of the tissues may be ranked as a cause. Rickets and lymphatism are very frequently associated; sometimes rickets is to be reckoned as a cause, and sometimes both conditions depend upon the same causes.

The local manifestations of lymphatism are modified by the age of the child. During infancy, the glands which are most frequently affected are those connected with the gastro-enteric and the bronchial mucous membranes; in childhood it is those which are connected with the pharynx and tonsils. This localization, of that the susceptibility of the diffe enced by age.

The degree of enlargement o found in the different situations them, particularly by those who or young children. They have o conditions or clinical symptoms do. One or two examples will suf

Enlargement of the mesenteric the large and small intestine, are died of marasmus, and have been while in reality they were only the which is an almost constant accom ing of swollen Peyer's patches in other symptoms during life sugge looked upon as a confirmation o reported by Northrup, in which cul typhoid.

The condition under considerati nodes, but to the smaller ones disce the larger ones exist, immense num present.

Lymphatism is essentially a con we see a regular succession of retro of glands unless they become the sea nected with the digestive tract begin by the fifth or sixth year the enlarg the tonsils, adenoid growths of the are usually stationary after the seve a marked atrophy about the time of larged lymph nodes, the catarrhal with which they are associated, an which both depend, are important i eases which affect these mucous m creased susceptibility to scarlet feve eases, and most of all to tuberculosis.

*Table showing the Situation and the Drainage-Areas of the Various Groups of Lymph Nodes of the Head and Neck.**

	Name of the group.	Number and situation.	Organs or areas from which they receive lymphatics.
1	Sub-occipital	One or two; at nape of neck.	Scalp, posterior portion.
2	Mastoid.	Four or five small ones; in mastoid region.	Receive efferent vessels from group 1, and through them from part of scalp.
3	Parotid.	Five to ten; on the surface and in the substance of the parotid gland.	Scalp, frontal and parietal portions; orbit, posterior part of nasal fossa, upper jaw, posterior and upper part of pharynx.
4	Submaxillary.	Twelve to fifteen; along base of jaw, beneath cervical fascia.	Mouth, lower lip, gums.
5	Supra-hyoid.	One or two; median line between chin and hyoid bone.	Chin and middle portion of lower lip.
6	Superficial cervical.	Five or more; along external jugular vein, beneath platysma, but superficial to the sterno-mastoid.	Auricle, part of scalp, skin of face and neck, and some efferent vessels from groups 1 and 2.
7	Deep cervical, upper set.	Ten to sixteen; about bifurcation of common carotid and along internal jugular vein. They are just above upper border of thyroid cartilage and on a level with hyoid bone.	Lower part of pharynx, larynx, palate, tonsils and part of tongue, part of nasal fossa, deep muscles of head and neck, and from inside the cranium. Receive also efferent vessels from groups 3 and 4.
8	Deep cervical, lower set.	A chain in the supra-clavicular fossa.	Connect with axillary group by a chain along axillary artery; also with glands of mediastinum and with groups 7 and 9.
9	Sub-hyoid.	A few small glands below hyoid bone and near median line.	Communicate with group 8, and may connect below with chain of bronchial glands.
10	Retro-pharyngeal.	Two small glands in front of spine and upon prevertebral muscles.	Pharynx and part of nasal fossa.

SIMPLE ACUTE ADENITIS.

This is an acute inflammation of the lymph nodes which in infancy frequently terminates in suppuration. A certain amount of inflammation of the lymph nodes occurs in children in all acute processes affecting the mucous membranes, especially when they are severe or prolonged. Those in connection with the various internal organs are considered with the diseases of the organs. Acute inflammation of the external nodes is of sufficient frequency to require separate consideration. While this is probably always secondary to some pathological process in the skin or mucous membranes, the primary condition may be so slight as to be overlooked, and the adenitis may be the more important condition or may even assume the appearance of a primary disease. It is particularly in infants that this is seen, and it depends upon the unusually active absorption and upon the susceptibility of the lymphoid tissues at this age. The cervical glands are frequently affected, and occasionally those of the axillary and inguinal regions.

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* Modified from Treves after Curnow in the Lancet, 1879, vol. i, p. 397.

Etiology.—Acute adenitis occurs in children of all ages in connection with diphtheria, scarlet fever, measles, and influenza. In such cases it is often severe, and, particularly with scarlet fever, not infrequently ends in suppuration. With the simple acute catarrhal processes of the pharynx and rhino-pharynx adenitis also occurs, but it is usually mild and rarely suppurates. In infancy, on the other hand, acute adenitis is not only very common from simple catarrh, but often severe, and frequently terminates in suppuration. Ulcerative stomatitis, carious teeth, eczema of the scalp or traumatism, may excite adenitis in children of all ages. Axillary adenitis may result from vaccination; inguinal adenitis, from vaginitis.

Of 109 cases of acute adenitis, not including those associated with diphtheria, measles, or scarlet fever, more than three fourths occurred in the first two years, and half of them in the first year of life. This susceptibility of infants is very striking. The disease occurs frequently in those who are in other respects perfectly healthy, and often when the evidences of disease of the mucous membrane are slight. This is true not only of the cases of cervical adenitis, but also of others in which the inguinal glands are involved. The inflammation is excited in most of these cases by the absorption of pyogenic germs from the mucous membranes or skin; in some cases, as in diphtheria, probably by the action of toxines.

Lesions.—The changes taking place in the glands are acute congestion, with swelling, œdema, and active hyperplasia of the lymphoid elements. The process may terminate in resolution or in suppuration according to the intensity of the infection and the susceptibility of the tissues. When severe enough to cause suppuration, the adenitis is accompanied by considerable inflammation of the surrounding cellular tissue.

In a series of 109 acute cases of which I have notes, not including the specific infectious diseases, 96 were cervical, 9 were inguinal, and 4 axillary; 62 per cent terminated in suppuration, the latter being nearly all in infancy. Suppurative otitis was present in 16 per cent of the cases. Suppurative retro-pharyngeal adenitis (retro-pharyngeal abscess) was seen in several cases.

In infancy the disease is usually unilateral, or, if bilateral, the glands of one side are much more severely affected than those of the other. Suppuration is nearly always of one side, and usually the abscess starts from a single gland.

Symptoms.—The symptoms and course of the adenitis of the specific infectious diseases belong to their clinical history. Suppuration is infrequent, except after scarlet fever. It is very rare after diphtheria, and when present usually signifies mixed infection; I have seen it occur but twice.

The typical cases of acute adenitis are those which occur in infancy. There are present the symptoms of the original disease,—usually catarrh of the nose or rhino-pharynx, mouth, or ear, which may not be very severe, and sometimes is overlooked. The glands most frequently affected are the deep cervical group. The tumour appears just below the angle of the jaw at the anterior border of the sterno-mastoid muscle (Fig. 141). The swelling during the acute catarrh is not rapid or great, but continues after the original process has subsided until it reaches the size of a walnut or even a pigeon's egg. In the most acute cases there is marked inflammation of the periglandular cellular tissue, with pain, tenderness, and extra heat. If suppuration occurs, it is generally evident in the latter part of the second week, but sometimes it may be as late as the third or even the fourth week. In the axillary or inguinal region (Fig. 142) the symptoms of adenitis are essentially the same as in the neck. In the inguinal cases the degree of catarrh of the mucous membrane is often very slight.

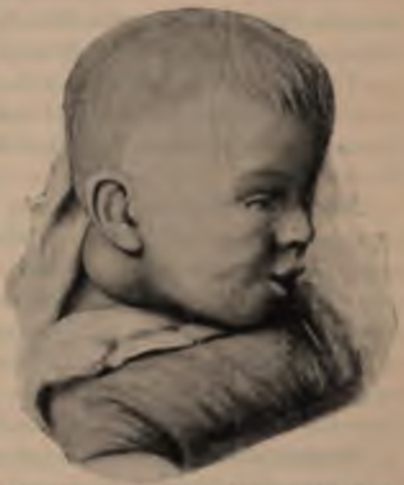
FIG. 141.—Acute suppurative adenitis in an infant one year old, showing the most frequent situation of the tumour in the cervical region.

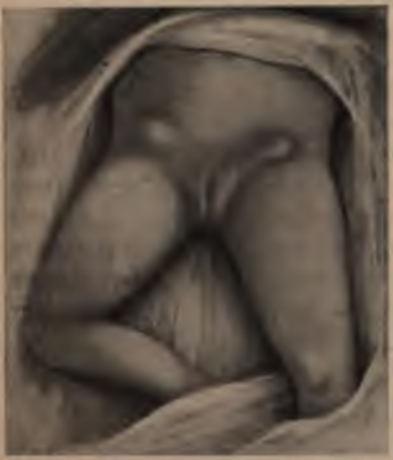
FIG. 142.—Acute suppurative adenitis (inguinal) in an infant three months old.

Most cases run their course with slight fever and few general symptoms; but in young infants the constitutional symptoms are often severe and the physician may be in doubt whether the local process is sufficient to explain them. The temperature may be from 102° to 104° F. for several days, with considerable prostration, which is much increased if there is complicating otitis. After suppuration, if freely opened at the proper time, the abscess heals rapidly and permanently, a sinus being rare. Occasionally infection extends from one gland to another, and a succession of these glandular abscesses occurs.

In the non-suppurative cases the swelling may be even greater than in those which suppurate; but it is less diffuse and apparently limited to the gland. It subsides slowly in the course of from four to eight weeks, often leaving a small tumour which may be apparent for several months. In susceptible children recurrent attacks of acute inflammation may lead to chronic enlargement which may last indefinitely. These glands do not become cheesy, except from subsequent tuberculous infection.

The acute cases in infancy in which suppuration occurs, appear to recover about as promptly and quite as completely as those terminating in resolution, although in the former the constitutional symptoms are more severe.

Diagnosis.—This is usually easy if it is remembered that, with the exception of the specific infectious diseases, and occasionally local causes like eczema of the scalp, carious teeth, etc., acute adenitis is essentially a disease of infancy. I have often seen it mistaken for mumps when the swelling was severe, but on close examination there is but little resemblance between the conditions. The disease is essentially acute, and has nothing in common with the slow suppuration seen in later childhood from the breaking down of tuberculous glands.

Treatment.—Prophylaxis requires that in all acute catarrhs, the mucous membrane should be kept as clean as possible by the use of nasal or pharyngeal sprays, or by syringing with simple solutions like Dobell's or Seiler's (page 56), or one of common salt.

In the stage of acute inflammation very hot applications or an ice-bag may be used for the relief of pain. It is very doubtful whether either of these means has much influence in preventing suppuration. If abscess forms, incision had best be deferred until pointing has taken place. If this plan is followed, refilling is rare. A simple free incision with proper antiseptic treatment is all that is required. Curetting may be done if there is much broken-down tissue present, but it is not usually necessary. In most of the cases the abscess promptly heals and a perfect cure takes place. In cases which do not suppurate, absorption may be promoted by the internal use of the iodide of potassium in full doses,—gr. x to xv daily to an infant of one year. I confess rarely to have seen any benefit from painting with iodine or from inunctions of iodine ointment or the oleate of mercury. If adenitis is secondary to carious teeth, eczema, or ulcerative stomatitis, these conditions should receive appropriate treatment. Such cases do not usually suppurate, but subside rapidly when the primary cause is removed.

SIMPLE CHRONIC ADENITIS.

This consists in a simple hyperplasia of the lymph nodes. There are considered here only the external glands, but those of the cavities of the body are affected in a similar way, in diseases of the mucous membranes with which they are connected.

Simple chronic adenitis is not nearly so frequent as the acute form even in infants and young children, and it is rare after the fifth year. It may follow one or more attacks of acute adenitis, or it may result from subacute or chronic inflammations of the skin or of the various mucous membranes, infection from which causes the acute form. The same groups of glands are affected in both varieties. The most frequent subjects are children who have the diathesis described as lymphatism.

Symptoms.—The glands upon both sides of the neck are usually involved, and more often a group than a single gland. The degree of swelling is not generally great, being much less than in acute adenitis, and usually less than in the tuberculous form. There are no constitutional symptoms. Hypertrophy of the tonsils and adenoid growths of the pharynx are frequently present. There is seen no tendency to suppuration or caseation. The swelling usually increases slowly for one or two months, then remains stationary for about the same length of time, after which it slowly subsides, although it may not entirely disappear for years. A subacute course is more frequent than a very chronic one.

Diagnosis.—These cases are especially to be distinguished from those of tuberculous adenitis. The most important points for differentiation are: that they occur, as a rule, in children under five, and most frequently under three years, a period when tuberculous disease is not very common; that some definite exciting cause is usually present; that caseation and suppuration do not occur; that the glands do not become adherent to the skin or to the deeper tissues; that they enlarge much more rapidly than do the non-caseating tuberculous glands; and that they are influenced to a much greater degree by constitutional treatment. There are, however, some cases in which a differential diagnosis is impossible. Glands in which there was originally only a simple hyperplasia may undoubtedly become tuberculous by subsequent infection.

Treatment.—Operative measures are not called for. The local cause usually to be found in the pharynx, nose, or mouth—hypertrophied tonsils, adenoid vegetation of the pharynx, decayed teeth, etc.—should be removed whenever possible. Little benefit is seen from local applications. The syrup of the iodide of iron (twenty drops three times a day to a child of four years) or potassium iodide (five grains three times a day) should be given for a long period. In some cases more decided benefit is seen from arsenic (four drops of Fowler's solution in a glass of water three times a day). In all cases cod-liver oil should be given except during warm weather.

SYPHILITIC ADENITIS.

It is quite rare that a marked degree of glandular enlargement is seen as a symptom of hereditary syphilis; indeed, so rare that it is often for-

gotten that chronic multiple glan
disease. In the few examples tha
has been a late symptom of hered
ments have been cervical and m
often been marked. They may be
mucous membrane of the throat
disease. The diagnosis of syphil
late manifestations of the disease–
teeth—and the prompt improveme
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TUBERCUL

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in infancy, although a frequent for
is exceptional to find them associat
they more often follow than prece
majority of cases it is the cervical g

Etiology.—The age at which tu
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first affected. The question often ar
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tions; however, my own conviction
process is a tuberculous one from the

Children who are by inheritance
also who are prone to glandular enla
by no means identical—are the ones
acute infectious diseases, particularly
frequently play the rôle of exciting c

The age of those affected corresponds very closely with that at which most children are seen with hypertrophied tonsils and adenoid growths of the pharynx. The subsidence of symptoms about the time of puberty, is also characteristic of both conditions.

Lesions.—It has been already stated that in the great majority of cases the cervical glands are involved, and generally they are the only ones affected. In 155 cases of tuberculous glands in the series reported by Treves,* those of the neck were the seat of disease in 145 and the only seat in 131; those of the axilla were involved in 17, but alone only in 4; the groin in 8, and alone in 6. This indicates the close association of the disease with infection through the upper respiratory tract. The glands first affected are most frequently the upper set of the deep cervical group; sometimes, however, it is the superficial glands of the submaxillary, or the parotid group, and occasionally the submental or the pre-auricular.† The chain of deep cervical glands which is involved, follows the carotid artery, and often extends some distance below the clavicle. These deep glands are sometimes connected with the bronchial group.

The process in all tuberculous glands is essentially a chronic one, but pathologically the cases may be divided into two groups, corresponding somewhat to the forms of disease seen in the lungs. In the first group the process is more rapid, and tends to early caseation and softening; the products of inflammation are mainly cellular, and the amount of fibrous tissue is small. In the second group the course is much slower, and fibrous tissue predominates, the cells being fewer, and caseation and softening infrequent.

In the first group the glands in the early stage are swollen, of a pale pink colour, and homogeneous; later they become more firm, and show, as the first gross evidence of tuberculous deposits, small grayish-white spots, which are generally numerous and scattered through the affected gland; these spots enlarge, and may coalesce to form one large gray mass, involving nearly the whole gland. Subsequently there is caseation and then softening, usually beginning in the centre of the caseous area. Inflammation within the gland is followed by that of the surrounding tissues, which may result in adhesions or in the formation of a periglandular abscess. The first change in the gland is the production of epithelioid and giant cells, about which there is a zone of small round cells; cheesy degeneration then begins in the centre. The caseous masses may become encapsulated by the production about them of fibrous tissue; or softening may occur at one or more foci, and an abscess form. Such an abscess contains curdy materials but very little true pus, the contents being

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* Scrofula and its Gland Diseases. Smith, Elder & Co., London, 1882.

† Nicoll, Glasgow Medical Journal, January, 1896.

this is possible. Internally the
virtues are cod-liver oil and the s
should be given in full doses—i.
day, to a child of six years. Arse
Local applications are of little valu
painting with iodine and poulticin
parts should be protected against
as little as possible.

It is important in every case t
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the adenoid tissue of the pharynx s
sive, since these are the two regio
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All these, if they do no more, keep
produce conditions which are most
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Operative measures.—These are
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Nature are, that it leaves a clean s
that it shortens the disease and pre
cases left to themselves; that it is
the danger of general infection by r

With reference to the choice of
agreed. The indications for the diff
seem to me to be the best that have

1. Excision and enucleation.—A
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indolent; where there are one or t
smaller ones, all freely movable and
a single large tumour causing pressu

2. Scooping.—Adapted to gland
herent, especially to the skin; also
This operation should not be done
tion.

3. Cautery puncture.—Useful bo
those which are soft and adherent; p
to the skin, and for these it is better
to glands smaller than a cherry. T
cautery point, which is thrust throug
in two or three directions through it
is applied. Although widely used in

mation. The whole course of the disease varies from several months to as many years. . Treves gives three and a half years as the average duration where suppuration occurs. The glands first affected are usually those situated near the bifurcation of the common carotid artery. Such tumours usually make their appearance just in front of the sterno-mastoid muscle—sometimes behind it—and at the level of the upper border of the larynx or the hyoid bone. In the more rapid cases the tumours usually attain a considerable size in three or four months, sometimes in half that time. The usual size reached is from that of an almond to an English walnut. At first the tumours are movable and preserve their distinct outline; later they become adherent, first to the deeper tissues and to each other, finally to the skin, and there is formed an irregular nodular mass in which it is sometimes difficult to make out the individual glands. As they approach the surface there are small spots of softening; then there is distinct fluctuation; the skin becomes discoloured and finally gives way, and there is a discharge of thick, curdy pus, which may continue for an indefinite time, until the whole of the broken-down gland has been thrown off.

In the cases which progress more slowly, a chain of glands is usually involved which individually are smaller than the preceding, and yet together they may form quite a large mass. These rarely become adherent, except to each other, and suppuration is very infrequent; the skin over them therefore is generally healthy. In most of the cases where suppuration has not occurred an improvement takes place about the time of puberty. In what proportion of these glands there is suppuration it is impossible to say. Like other tuberculous lesions in the body, these glands are much more often the seat of infection than was formerly supposed, and in many cases the diagnosis is not made. Of those recognised clinically as tuberculous adenitis, from one half to two thirds suppurate, provided they are allowed to run their natural course. Resolution is more likely to occur where the progress is slow, and where there are many small tumours than with one or two large ones. If softening has occurred, resolution is not to be expected, although even in such cases encapsulation of the cheesy foci may take place. Occasionally cases are cured by intercurrent acute disease. A cure has been known to follow an attack of scarlet fever, and erysipelas of the face (Treves). The usual effect of the eruptive fevers, however, is to accelerate the process.

Two forms of suppuration occur in connection with tuberculous glands,—one an abscess of the gland proper, the other outside of and usually over it. In a typical case of the first variety, the gland is distinctly outlined and often superficial, there is very little inflammation, the spot of softening and fluctuation is small, and the pus discharged is always curdy. In the second variety the abscess is preceded by a more diffuse swelling, and the outline of the gland may not be made out; the signs of inflammation are more marked, the area of fluctuation is larger, and the pus is more like that of any ordinary abscess. Often the two varieties are combined; as when a gland beneath the deep fascia breaks down and there is formed directly over it an abscess in the cellular tissue, which communicates through a narrow opening with the gland beneath. In such cases the discharge may continue for a very long time, until the whole of the gland has been removed. If healing occurs before this, the cicatrix soon breaks down.

Where abscesses are allowed to open spontaneously, large, irregular, and usually very intractable ulcers often form. The skin is undermined for a considerable distance, and it has an unhealthy appearance. Such ulcers sometimes continue for many months in spite of all treatment, particularly if the patient's general health is poor. The scars left after them are large and unsightly, and sometimes positively deforming (Fig. 143). Their appearance is quite characteristic. They often have many tabs of skin attached to them; they may form prominent ridges which may undergo contraction like those after burns; they are of a purplish-red colour, and adherent to the deeper tissues. They are often sensitive and painful. As time passes they atrophy and become less conspicuous, though they remain through life.

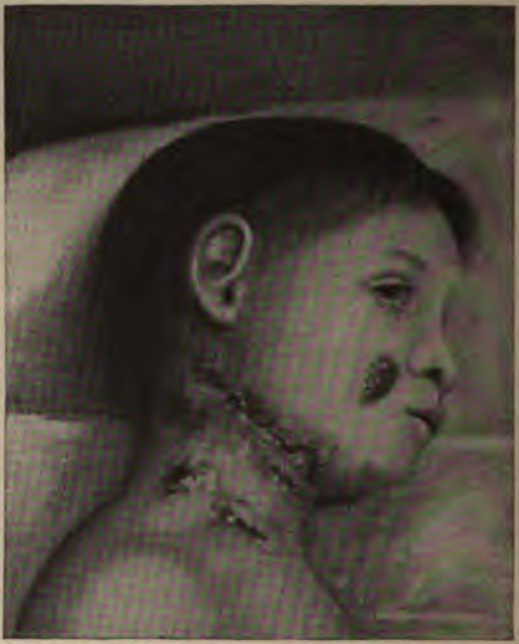

FIG. 143.—Cicatrices following a neglected case of tuberculous adenitis, in a girl seven years old. There is also a tuberculous patch upon the skin of the cheek in a very frequent location.

The general health of children with tuberculous glands may be much or little affected, and not a few remain in good condition throughout the whole course of the disease, particularly when suppuration does not occur, but sometimes even when it is protracted.

Prognosis.—In no case, I think, does tuberculosis of the external lymph glands cause death. Though the course is often protracted, lasting in some cases for eight or ten years, ultimate recovery may be confidently predicted in the great majority of cases. As stated at the beginning of this article, it is a matter of surprise that so few of these children ultimately develop general tuberculosis. Treves[*] says, "The percentage of those who fall victims to diffused tubercular disease is so small that the probability of that disease may be put out of the question," and that to urge the prevention of phthisis as an argument for operation "is unworthy of consideration." Poore[†] states that of fifty-eight cases, only two were known to have died of tuberculosis. Nordan on the other hand reports that of 149 cases that were followed, eighteen per cent were known to have died from tuberculosis, and nine per cent, though living, were suffering from that disease. Although it is certainly infrequent, I can not believe such a sequel to be quite so rare as do the two authors quoted.

Diagnosis.—Tuberculous adenitis is to be distinguished from simple chronic enlargement, from that due to syphilis, from Hodgkin's disease, and from malignant disease. The diagnostic features of tuberculous glands are the age of the patient—usually from three to ten years—the site of the primary swelling, the indolent course, the trifling original cause, and most of all the disposition to slow caseation, softening, and abscess. The cases of simple hyperplasia are usually in children under five years, their progress is much more rapid, there is often some definite cause, and they have in most cases nearly or quite disappeared in the course of three or four months. They suppurate, if at all, during the first month. Syphilitic disease is to be recognised mainly by discovering the evidence of syphilis elsewhere, and by the effect of treatment. In Hodgkin's disease, glandular groups in other parts of the body are involved simultaneously or in rapid succession. There are no signs of inflammation or caseation; and the swellings are accompanied by very marked and definite constitutional symptoms,—anæmia, emaciation, and general prostration. Malignant growths are very rare, they increase rapidly, often attaining a great size in a few months.

Treatment.—The general treatment of tuberculous glands is to put the child under the very best surroundings possible. The seaside has a great reputation for such cases, and no doubt the majority do very well there; but some are benefited even more by a dry, mountain climate. At all events, a child from the city should be sent into the country whenever this is possible. Internally the only re virtues are cod-liver oil and the syrup of should be given in full doses—i. e., twen day, to a child of six years. Arsenic and Local applications are of little value and n painting with iodine and poulticing shoul parts should be protected against cold, a as little as possible.

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[*] *Loc. cit.*, p. 188.

[†] New York Medical Journal, June 23, 1892.

It is important in every case to remo sources of local irritation. Hypertrophie the adenoid tissue of the pharynx scraped sive, since these are the two regions whic tubercle bacilli. Any pathological condit trophy of the turbinated bodies, should re chronic otitis, chronic conjunctivitis, cario All these, if they do no more, keep up a co produce conditions which are most favour bercle bacillus.

Operative measures.—These are indicat of constitutional treatment, the glands af size and number. The advantages of ope Nature are, that it leaves a clean scar ins that it shortens the disease and prevents t cases left to themselves; that it is a radic the danger of general infection by removin

With reference to the choice of operati agreed. The indications for the different o seem to me to be the best that have been fo

1. Excision and enucleation.—Adapted tive inflammation and no softening; where indolent; where there are one or two lar smaller ones, all freely movable and all cle a single large tumour causing pressure sym

2. Scooping.—Adapted to glands whic herent, especially to the skin; also where This operation should not be done during tion.

3. Cautery puncture.—Useful both in those which are soft and adherent; particula to the skin, and for these it is better than th to glands smaller than a cherry. This op cautery point, which is thrust through the s in two or three directions through it, after is applied. Although widely used in Europ

employed in America,—not so often, it would appear, as it should be, from the advantages claimed for it.

All surgeons agree that in operating, violent tearing out of the glands should be avoided; that as little injury as possible should be done to the tissues; that the capsules should not be torn nor the tuberculous materials allowed to escape into the healthy tissues. All agree also that prolonged dissections are to be avoided, and that in removing deeply-seated glands there is great danger of injuring vessels and nerves and the dome of the pleura.

Glandular abscesses should in all cases be opened as soon as pus forms, to prevent the extensive undermining of the skin, which is so likely to occur. The opening should be a small one, and all squeezing of the gland or surrounding tissues avoided.

HODGKIN'S DISEASE (ADÉNIE).

This is a rare disease in which there is a general hyperplasia of the lymphatic glands throughout the body, with growths of lymphoid tissue in the spleen, liver, and other internal organs. It is accompanied by marked anæmia, is progressive in its course, and usually terminates fatally. The cause is unknown. It is much more common in males than in females. Its occurrence in childhood is exceedingly rare.

The changes in the glands consist in a simple hyperplasia, which may be extreme. Suppuration and caseation are very rare, if indeed they ever occur. Any of the external or internal groups of lymph glands may be affected, and in severe cases the disease may involve almost every chain of glands in the body. Of the external groups, the cervical and the axillary are usually most affected; of the internal groups, those of the mediastinum and the retro-peritoneal region. The spleen and the liver are moderately enlarged, and lymphoid growths, varying in size from a pin's head to a grape, are usually scattered throughout their substance. There may be changes in the bone-marrow.

Symptoms.—These come on very gradually, often insidiously. The external glandular swellings are usually the first noticed, but sometimes it is the anæmia which first attracts attention; occasionally it is the local symptoms resulting from the pressure of internal glands, which may give rise to œdema, pain, cough, or dyspnœa. The progress is generally slow but steady, and the glands may reach an immense size. The blood shows a moderate reduction of the red and an increase in the white cells, particularly the lymphocytes (Osler).

Treatment.—The only remedy which is of much avail in this disease is arsenic, which must be given in full doses and for a long time. The general treatment should be tonic.

CHAPTER

DISEASES OF THE

Weight.—From one hundred and fort
York Infant Asylum the following were
ferent ages:

Weight of the Spleen in Infancy

AGE.
Birth
Three months
Twelve "
Two years
Three "

Position and Methods of Examination
spleen is close against the diaphragm, its
the ninth, tenth, and eleventh ribs. Its a
ward as the middle axillary line, its post
the vertebral column. In infancy it is p
the spleen by percussion, unless it is enl
the spleen is often depressed enough to
ribs, but at other times it can not be felt
downward by some pathological conditio
long axis of the spleen is nearly parallel
organ is much enlarged, its axis corresp
from the axillary line at the border of
part's ligament.

The thin abdominal walls of young ch
spleen much easier than in adults; and
method of examination than is percussion.
cussion are so uncertain and misleading
dispense with it, and rely on palpation
spleen. For satisfactory palpation it is ne
should not be tense. It is therefore imp
quiet, and that the examination be mad
force or undue pressure used. The child
the thighs flexed and the skin, of course
having taken the trouble to warm his ha
side of the patient and make pressure wi
are semiflexed. The pressure should be
creased, the fingers being then held stati
spiratory movements. It is sometimes be

hand for palpation, and make pressure with the other directly over the first. Palpation should be made in the axillary line. If the examination is satisfactory, and in the great majority of cases it is so if the child is quiet, the spleen can easily be felt when it is sufficiently enlarged to be of any diagnostic importance. With a little practice one can readily detect even slight degrees of enlargement.

When moderately enlarged, the lower border of the spleen is an inch or so below the free border of the ribs; when greatly enlarged, it forms a tumour which may nearly fill the left half of the abdomen. A tumour in the left hypochondriac region is recognised to be the spleen, by the fact that it is freely movable laterally and at its lower border or extremity, while it is attached above; also its inner border can usually be felt to be thin and sharp, and marked about its middle by quite a deep notch.

ENLARGEMENT OF THE SPLEEN.

In Acute Disease.—The spleen is most frequently and most constantly enlarged in malarial and typhoid fevers, but it is occasionally so in all the acute infectious diseases.

In most of these cases the enlargement is chiefly from congestion, but there may be acute hyperplasia and an increase in size of the Malpighian bodies. It may contain small hæmorrhages, and in extremely rare cases the spleen may rupture. In appearance it is generally dark-coloured, soft, and somewhat friable. In the cases which recover, the splenic swelling subsides with the original disease.

In Chronic Disease.—Like the lymph nodes, the spleen is much more often enlarged in children, particularly young children, than in adults. Enlargement is seen at times in almost all the chronic diseases of early life; but it occurs most frequently in rickets, syphilis, malaria, tuberculosis, the blood diseases, and in amyloid degeneration. Besides, it may be the seat of primary disease, either simple or malignant.

Rickets.—The splenic enlargement which accompanies rickets is generally seen during the first year; at this period it is very frequent. The swelling is usually moderate, but occasionally it is so great that the lower border is three or four inches below the ribs. It belongs to the most severe forms of the disease.

Syphilis.—Enlargement of the spleen is one of the most constant lesions in congenital syphilis. It is present with great uniformity in children born with syphilitic lesions, and very frequently during the active period of the disease in early infancy. It is seen at a later period during infancy or childhood, associated with other late symptoms. The degree of enlargement is often great. In several cases I have seen it sufficient to form a large abdominal tumour. The liver also is increased in size, but not to such a degree. The pathological changes in the spleen in syphilis are considered with that disease.

Küttner * has made a study of the bloo and rickets that were accompanied by sp ber of red cells was found to vary greatl white cells.

Malaria.—The swelling in these case is not so often enlarged as in syphilis. T posure in a malarial district.

Tuberculosis.—It is rare to find anythi ing of the spleen in tuberculosis. In the due to the fever and general infection; i depends either upon tuberculous deposi venous obstruction, the result of the pulm

The blood diseases.—Marked enlarge many cases of simple anæmia accompa This is quite peculiar to infancy and early stantly swollen, and usually greatly so, in infants, in leucæmia, and in Hodgkin's di the liver is also enlarged, but to a much the others it is but slightly changed.

Amyloid degeneration.—The causes of symptoms are mentioned in connection w (page 413). The spleen is constantly in this organ, as well as that of the liver, m resemble those found in the liver.

Cardiac disease.—In all forms of car ditions in which there is obstruction to t the spleen is enlarged. It is seen in co cases. The liver is usually enlarged to abo and there may also be dropsy of the feet.

New-growths, tumours, etc.—In rare ca seat of new-growths; these are usually var has also been reported. Lymphoma, or, as ple hyperplasia of the spleen, has occasio apart from any of the constitutional disea

Acker (Washington) has reported a re of eight years, who died of scarlet fever was first noticed. At the autopsy the sp There was found a very great degree of h ing malignant disease.

Echinococcus of the spleen has been r far as I am aware, in America, among chil

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* Jahrbuch für Kinderheilkun

CHAPTER IV.

DISEASES OF THE BONES AND JOINTS.

ACUTE ARTHRITIS OF INFANTS.

THE term *acute arthritis of infants* has been given by Thomas Smith, Townsend,[*] and others, to a form of joint inflammation which is peculiar to infancy and not very rare at this time. It has been described under the names of *acute purulent synovitis of infants*, *acute epiphysitis*, *pyæmia of bone*, *acute osteo-myelitis*, etc. The disease is essentially a form of pyæmia, and is a suppurative process almost from the outset. It may begin at the epiphyseal junction, in the medullary canal, or in the joint; usually, however, the joint is invaded secondarily, the disease sometimes spreading to it with great rapidity from the bone. It may also result in a diffuse osteo-myelitis or in a subperiosteal abscess. Secondary abscesses may form in the viscera or in distant articulations. As a consequence of the disease, there may be separation of the epiphysis from the shaft, sometimes entire destruction of the articular extremities of the bone or articular cartilages. As late results there may be a pathological dislocation, or a "flail joint"; less frequently there may be anchylosis. The extent of the ravages in the joint structures depends chiefly upon the duration of the process. Where the pus is evacuated early, recovery may take place with very little permanent damage; but in neglected cases complete destruction of the joint often occurs.

Etiology.—Of 73 cases collected by Townsend, all but four occurred during the first year of life, and over half of them during the first three months. These early cases have already been mentioned among the Pyogenic Diseases of the Newly Born (page 82). So far as is known, the disease has no relation either to syphilis or tuberculosis. There is in some cases a history of traumatism, but this can only play the rôle of an exciting cause. The essential cause of the disease is the entrance of pyogenic germs into the circulation. They may gain admission through the umbilicus, some abrasion of the skin, or the conjunctiva (pages 79, 80). Very often the source of infection cannot be discovered. Cases occurring later than the first few months of life have sometimes followed measles, scarlet fever, or empyema.

Symptoms.—The onset is often sudden, with well-marked local and constitutional symptoms. The disease may be ushered in with a chill, followed by a fever, which is frequently high, fluctuates widely, and is accompanied by general prostration, restlessness, and other signs of pain.

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[*] W. R. Townsend, M. D., American Journal of the Medical Sciences, January, 1890. Here will be found a full discussion of the subject, and the bibliography.

There is rapid swelling about the affected as the lesion is deep-seated. There is also deformity. Later there are redness, œdem tuation. In some cases the constitutional s After pus forms, it may lead to rupture of all the tissues about the joint, often burrow before it reaches the surface.

When its progress is most rapid, death r from exhaustion or general pyæmia. The l multiple. The usual duration is from o generally being evident in four or five days cases the joints were affected in the foll knee, in 27; shoulder, in 12; wrist, in 5; el in 2; toes, in 1; sterno-clavicular, in 1. I l suppuration occurred in the temporo-ma joints; in another, in the temporo-maxill cent of the cases collected by Townsend or of these two thirds recovered; in the rema ple joint lesions, only one fourth of the case vive the acute period, the number who reco

Diagnosis.—The disease is not usually the constitutional symptoms, the marked formity, and the rapidity with which sup mistaken for rheumatism, although rheum it may be practically ignored. Syphilitic localized pain, tenderness, and general in swelling, fever, and severe constitutional sy prolonged. Acute cellulitis in the neig resemble it, but this is rare except from little in common with tuberculous bone dis

Treatment.—The general treatment i patient's condition, and the purpose of it support the general strength. Suppurati time should be wasted in trying to allay t cations. The best results are obtained b and thorough antiseptic treatment. Fixa operation, in order to prevent deformity.

THE TUBERCULOUS DISEASES OF

The chronic forms of tuberculous bo insidious onset and the frequency with whi more frequently fall, in the early stage physician than into those of the genera that will be attempted in this chapter wil the most important forms—viz., disease of the vertebræ, hip, and knee—dwelling particularly upon the early symptoms and diagnosis. For their fuller discussion, particularly as to the details of treatment, the reader is referred to text-books on general or orthopædic surgery. The causes are the same, and the lesions are very similar in all forms, and will therefore be considered together.

Etiology.—The age at which tuberculosis of the bones most frequently begins, is from the third to the eighth year, it being comparatively rare before the end of the second year. The sexes are affected with about equal frequency. Tuberculous bone disease may occur in a child who has previously been in apparent health, but more often in one who has been reduced by some previous illness, especially the infectious diseases of childhood; of these, it most frequently follows measles and whooping-cough.

A history of inherited tuberculosis is present in a large number, but by no means in a majority of the cases. Like tuberculosis of the cervical glands, it is rarely preceded by other tuberculous processes, although it may be followed by them. It usually appears as an example of primary infection; but it seems very improbable that such should actually be the case. It is more likely that there has previously been a latent focus of tuberculosis elsewhere in the body. In many cases, antecedent disease of the bronchial glands has been demonstrated by autopsy. Infection from these or from other tuberculous lymph glands, is the most probable explanation of the origin of infection in cases of bone disease. However, by some writers, notably Baumgarten, tuberculous disease of bone is regarded as due to direct inheritance, and is to be compared to the bone lesions which occur as late manifestations of hereditary syphilis.

Traumatism is often an exciting cause, and it may determine the site of the disease.

Lesions.—The tuberculous joint diseases of childhood are, as a rule, secondary to disease of the bones. Hip-joint disease usually begins in the head of the femur, and knee-joint disease in one of the condyles; ankle-joint disease in the lower epiphysis of the tibia, etc.

The frequency with which disease is seen in the different locations is shown by the following table, which gives the number of cases of each form applying for treatment at the Hospital for Ruptured and Crippled, New York, during the years 1884 to 1893 inclusive:

Spine	2,145	cases,	or	37·5	per cent.
Hip	1,937	"	"	34·0	"
Knee	1,222	"	"	21·5	"
Ankle or tarsus	255	"	"	4·5	"
Elbow	71	"	"	1·2	"
Wrist	50	"	"	0·9	"
Shoulder	24	"	"	0·4	"
Total	5,704			100·0	

The character of the bone disease upon
pends is generally a primary ostitis, which a
of the long bones usually beginning near th
bones it is a central ostitis. The stages in t
swelling, and cell infiltration, followed by
softening and suppuration. In the early
larged, and on section one or more yellowish
disease may be arrested in this stage, enca
products taking place; or it may continue
extensive breaking down or disintegration
disease extends there are involved, the peri
and finally the joint itself. Abscess may f
parts surrounding the bone. The process is
disease of the lung. As the disease advance
loosened, and displacement of the parts o
deformity, due partly to muscular contracti
the body. The inflammatory process wit
generally goes on to a certain point, where
broken-down bone substance is separated an
in the discharge, and a reparative process
healthy bone. Where joint structures ha
place by bony anchylosis. Sometimes the
surface without involving the joint; at ot
arrested, and its products become encapsul
mation of the joint may occur by a gradual
process, or by a sudden perforation of the
of extensive disease, all the joint structures
membrane, ligaments, articular cartilages, a
ing the joint. The process of disintegratio
very chronic and measured by months or y
disease is from one to ten years, three years
tion. In the great proportion of cases but
it is not infrequent in hospitals to see two
the large joints affected in the same patient

Secondary lesions.—Abscesses form in
the cases, and often burrow a long distance
Amyloid degeneration of the liver, spleen,
the villi of the intestines, occurs as the res
tion, chiefly in connection with disease of
with that of the knee. General or local
tuberculous meningitis, may develop at any

CARIES OF THE SPINE—POTT'S DISEA
inflammation of the bodies of the vertebræ,
tral portion and extending to the perioste

in fact, to all the contiguous structures. It frequently involves the membranes of the cord, the roots of the spinal nerves, and even the cord itself. The number of vertebræ usually affected is from two to five. The gross appearance of the lesion in a well-marked case is shown in the accompanying cut (Fig. 144). After the bodies of the vertebræ have become softened and partially broken down by disease, the pressure from the superincumbent weight of the body causes them to fall together and produces a backward displacement of the spinous processes, giving rise to the deformity known as kyphosis, which in its extreme form is popularly known as "hunchback."

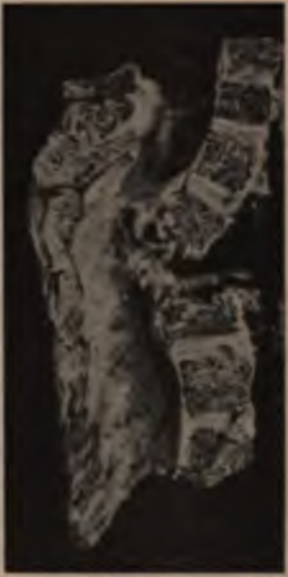

FIG. 144.—Pott's disease of the upper dorsal region; a vertical section of the spine, showing disintegration of the bodies of the vertebræ and encroachment upon the spinal canal. (From a patient dying in the Hospital for Ruptured and Crippled.)

Any part of the vertebral column may be affected; but the disease is most frequent in the dorsal region, as shown by the following statistics from the Hospital for Ruptured and Crippled: of 2,143 cases, 72·5 per cent affected the dorsal region, 15·3 per cent the lumbar region, and 12·2 per cent the cervical region.

Symptoms.—The onset is gradual, often insidious, and the early symptoms are frequently overlooked or misinterpreted. The case may go on for weeks or even months before the true nature of the disease is recognised, which is often not until deformity has occurred. In nearly all cases, however, the early symptoms are sufficiently characteristic to enable a careful observer to make a diagnosis before the stage of deformity.

The most constant early symptoms are: (1) pains caused by the irritation of the nerve roots and referred to various parts of the body, following the distribution of the spinal nerves; (2) rigidity of the spine from muscular spasm, this being an attempt to prevent motion at the seat of disease; and (3) the assumption of various postures calculated to relieve pressure upon the diseased vertebral bodies. Sometimes the first symptoms are those of pressure-paralysis (page 768); at others they are the local signs of abscess. In addition to the local symptoms mentioned, there is usually disturbed sleep, often accompanied by moaning.

Cervical disease.—The pains are often felt above the point of disease, frequently in the form of occipital neuralgia; sometimes they are referred to the front or the side of the neck. They may be so frequent and so severe that the face assumes a constant expression of anxiety or distress. In other cases pain is excited only by an attempt at movement. The

muscular spasm most frequently takes the
times of slight opisthotonus; sometimes t
head by a tonic spasm of all the muscle
passive motion is resisted, and any moven
child involuntarily steadies its head wit
come on gradually and are persistent. Son
the first thing to attract attention is a p
extremities, which proves the beginning o
first marked symptoms are those due to t
geal or a retro-œsophageal abscess (page 2

The deformity from cervical disease
the disease is located elsewhere. Usually
thickened in a nearly uniform way, and
settled downward upon the shoulders.
kyphosis is not infrequent; but in the mi
more often an anterior prominence, whic
wall of the pharynx.

Dorsal disease.—The referred pains ar
and take the form of intercostal neuralgia
abdomen. They are often ascribed to cold
There is a disposition to assume the pro
also to lean across a chair or the lap of th
fully, holding the spine erect and very st
in getting into or out of bed, or in rising
the beginning there may be a slight lordos
of disease, instead of the usual kyphosis
latter soon takes its place, and with it is se
the lumbar region.

Lumbar disease.—The first symptoms
ness, referred to one of the lower extrem
the suspicion that the hip is the seat of di
ness there may be a tilting of the pelvis t
a distinct lateral curvature of the spine.
quent nor so severe as when the upper par
may be felt in the groin, in the loin, in t
the hypogastrium. The gait and attitude
ing the shoulders well back, the patient
holding the spine with the greatest care.
wardly and with difficulty. Deformity
marked as when the disease is dorsal, and
are symptoms due to the formation of psoa
one thigh, and a tumour may be found d
upper and inner aspect of the thigh; in b
mistaken for hernia.

Physical examination.—Whenever any of the above symptoms are present, the child should be stripped and submitted to a thorough examination, the purpose of which should be to determine, first, the existence of any deformity; secondly, the mobility of the spine; thirdly, the presence of any secondary lesions, such as abscesses or paralysis. The mobility of the spine is best determined by studying the attitude, gait, and posture of the child, and the manner of stooping or rising from the floor. The gait has already been described with the symptoms of lumbar disease. As it has been tersely put, "the child walks with its legs but not with its back." In stooping, the same disinclination to bend or move the spine is seen. It is often impossible to induce the child to stoop at all, and when it does so, to pick up some object, there is acute flexion at the knee and hip, but as little bending of the spine as possible. In rising from the recumbent position the same thing is seen. The posture and attitude of the child will be modified by the position of the disease, and somewhat by the activity of the process at the time; however, by comparing the movements referred to with those of a healthy child, the great difference will at once be apparent. If the symptoms point to cervical disease, a digital exploration of the pharynx for deformity or abscess should be made, and the extremities should be examined for paralysis. If the disease is in the lumbar region, deep palpation of the iliac fossa should be made to discover a psoas abscess, and the passive movements of the thigh should be carefully tested to determine whether there is any resistance to extreme extension, this often being present before the psoas tumour. No matter how clearly the lameness may be at the hip, it should be remembered that this often results from disease of the lumbar spine. If the thigh is flexed and freely movable except in extension, the symptoms are probably the result of psoas irritation, for in hip-joint disease the other movements of the joint are also resisted.

The deformity of Pott's disease is often spoken of as "angular" curvature of the spine. While this is a true description of the disease at an advanced stage, there is often in the early stage only a general curve. Later a slight knuckle is seen from the unnatural projection of a single spinous process. This deformity may increase and finally involve five or six vertebræ. It is usually greatest in the upper dorsal region. A slight prominence, which does not disappear on suspending the patient, is always suspicious.

Tenderness upon pressure over the spinous processes and increased sensitiveness to heat and cold, are rarely present. Pain may sometimes be produced by downward pressure upon the head or shoulders in the axis of the spine. This symptom is not necessary for diagnosis, and the attempt to elicit it is strongly condemned by Gibney, who has seen serious harm follow such a test.

Course of the disease.—Caries of the spine is a very chronic disease, its

course being measured by months or years,
diseases, by periods of remission and exace
follow traumatism, and is often accompani
scess. After the disease has lasted from o
inflammation ceases and repair begins, a
process of consolidation of the fragments o
production of anchylosis. Relapses are e
improper treatment or by discontinuing
before the disease is arrested.

Abscesses.—The frequency with which
what upon the treatment. Townsend stat
present in 20 per cent. They are rarely
months from the beginning of symptoms,
ond year of the disease. They sometimes
more frequently they appear as typical co
with cervical disease are retro-pharyngea
may open externally, usually just above the
mastoid muscle. Those with disease of the
vertebræ, are apt to burrow along the spi
gion; rarely they may rupture into the œ
Those with disease of the lower dorsal or l
above the iliac crest posteriorly, or burrow
nal muscles, but the usual course is for th
appearing in the groin just above Poupart
inner aspect of the thigh.

Paralysis occurs in about one half the c
the lower cervical and upper dorsal vertebr
ease is below the middle dorsal region (see C

Prognosis.—The actual mortality of P
so many of the consequences of the dise
appreciated until adult life is reached.
causes is from ten to twenty per cent. T
tion from prolonged suppuration, amyloid
tuberculosis, and tuberculous meningitis.
curs from pressure upon the cord in the u
pressure effects of abscesses in the posteri
mediastinum.

The prognosis as to the amount of per
upon the seat of the disease, the time at
upon the thoroughness with which it is ca
to deformity are obtained when the disease
gion. With improved methods of treatme
of these patients recover with an insignifi
some with none whatever.

Diagnosis.—The spinal deformity resulting from Pott's disease may be confounded with rachitic kyphosis or with rotary lateral curvature. Rachitic curvatures (page 225) are usually seen in children under eighteen months of age, a time when Pott's disease is rare; there are other signs of rickets present, and instead of rigidity there is usually undue mobility of the spine. What is true of rickets may be said of all curvatures depending upon malnutrition. Rotary lateral curvature is seen about puberty, rarely in young children except in connection with rickets. A slight lateral deviation of the spine, sometimes seen in the early stage of caries, may resemble a case of incipient rotary curvature. The latter is not attended by pain or rigidity, and is most frequent in young girls from eleven to fourteen years of age.

Other abscesses may be mistaken for those dependent upon vertebral caries. This difficulty is likely to exist in the cases attended by very little spinal deformity. These abscesses are most frequently in the iliac fossa or in the lumbar region, and may be due to perinephritis or appendicitis. The latter are more acute than those depending upon bone disease and usually accompanied by fever. Tumours of the vertebræ or of the spinal cord may give rise to symptoms almost identical with those resulting from compression myelitis due to Pott's disease, but both of these are extremely rare.

Treatment.—The treatment of Pott's disease is both general and local, and neither should be neglected. The constitutional treatment should be similar to that employed in other forms of tuberculosis.

The indications for local treatment are to put the diseased parts at rest, by immobilizing the spine and removing the superincumbent weight of the body. With the great advances made in orthopædic surgery it is no longer necessary to confine these patients in bed, as was formerly practised, to secure this result. It may be accomplished either by plaster-of-Paris, or some other form of jacket, or a properly fitting steel brace. A head-support should be attached to all forms of apparatus, if the disease is above the middle dorsal region. The closest attention to details and much experience in the use of apparatus are required to secure the best results. In perhaps no class of cases has the beneficial results of modern scientific treatment been more apparent than in those of Pott's disease. For the details in regard to the mechanical treatment and the different forms of apparatus, the reader is referred to works on general or orthopædic surgery.

ARTICULAR OSTITIS OF THE HIP—HIP-JOINT DISEASE—MORBUS COXARIUS.—In early childhood this generally begins as a chronic ostitis in the head of the femur, starting near the epiphyseal line. Exceptionally, and according to Gibney, oftener in older children, it begins in the acetabulum. The pathological process, as well as the clinical history, is generally described as consisting of three stages. In the first stage—that of ostitis—the lesions are limited to the bone; in the second stage—that

of arthritis—all the joint structures are in
ration usually occurs; in the third stage t
sorption of the head and sometimes of the
destruction of the ligaments, lead to ma
from muscular contraction. The disease
in the second stage, or it may continue th

Symptoms.—Clinically, the usual durat
four months; it may last only for a few
or three years, and the disease may be ar
is usually very gradual, and the symptoms
importance until they have continued for s
thing noticed is slight lameness, due to
beginning this may be seen only in the m
day. It may be accompanied by some ten
inclination to walk. A little later the ch
most frequently referred to the front of
the thigh, but only in rare cases to the hip
but gradually increases in frequency an
added the "starting pains" at night, whic
istic features of early hip-disease. These
spasm of the muscles during sleep. Th
without waking, sometimes wakes with a c
eral times during the night. Soon restless
day are present. The lameness, which at
or noticed only in the morning, comes t
week by week increases in severity. Th
may take only a few weeks, but sometimes
inexplicable manner during a period of
two years, before they are fully developed.

Physical examination.—Every child
with pains like those mentioned, should b
thorough examination. The first points t
late to the general contour of the hip; eve
should be carefully noted. Then the attitu
and finally all the functions of the joint
the limbs measured, to determine the exist
At every step a comparison should be ma
contour of the hip is changed quite unifor
flattening of the whole gluteal region;
prominent; the gluteal fold is shortened
double. There is no characteristic positi
There is atrophy of the thigh and often of
the appearance of a typical case in the full
In walking, the child favours the diseased

much as possible upon the sound limb; but all these symptoms are of much less importance for diagnosis than is an examination of the functions of the joint.

For this purpose the child should be placed upon a table upon its back, and the various movements of the hip—abduction, adduction, flexion, extension, and rotation—should be executed, first with the sound limb and then with the suspected one, the two being carefully compared at every point to determine the degree of motion allowed. It is not necessary that force should be employed or pain inflicted. If the symptoms have existed for some weeks, there is generally a limitation of motion at the hip in all directions, but first usually in abduction, rotation, or extension. In more advanced cases, no motion whatever may be permitted at the joint, the pelvis tilting with the slightest movement of the femur. This fixation of the hip is due to tonic muscular spasm. Crowding the articular surfaces together, by pressure upon the heel or trochanter, produces pain, which is usually referred to the joint. This test should be carefully made, lest injury be inflicted. Gibney cautions against examinations under ether, since in this way serious injury may be done unconsciously.

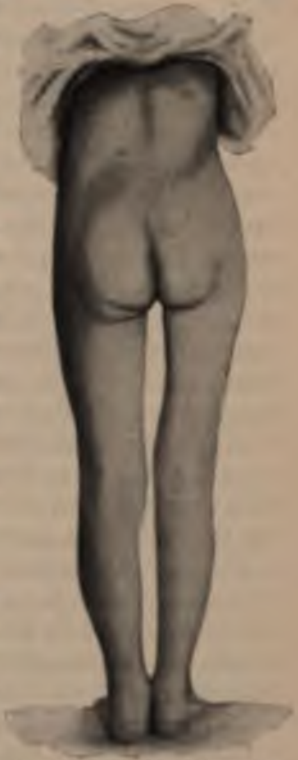

Fig. 145.—Hip-joint disease, at the end of the first stage, showing muscular atrophy, prominence of the trochanter, flattening of the gluteal region, and a single gluteal fold.

Second stage.—This has been called the stage of arthritis. Its existence may be assumed when the limb takes the position of marked permanent deformity, which is due at this period to muscular action, not to destructive bone changes. The transition from the first to the second stage is in most cases a gradual one, and the line between the two can not be sharply drawn. Sometimes, however, it is rapid, and marked by a sharp exacerbation of all the symptoms. This may indicate a sudden perforation of the joint, and the rapid development of suppurative arthritis. Such is the usual result when an abscess which has been slowly forming in the bone, opens into the joint; or acute joint inflammation may be lighted up without so evident a cause. Sometimes the pus reaches the surface below the capsular ligament, and the joint remains intact. An acute exacerbation is indicated by increased pain, excessive tenderness about the hip, often by inability to walk, or even to bear any weight upon the limb, and frequently by fever. The position assumed by the limb is now fairly

characteristic. The foot is generally evert
rotated outward, and the limb apparent
infiltration anywhere about the hip, due
The muscular spasm is so great that t
whatever being allowed. Abscesses may
hip; they are especially frequent at the
thigh, and may burrow long distances be
duration of the second stage also is indefi
few months to a year, or the disease may

Third stage.—There is now marked d
muscular contraction after absorption o
neck of the femur, and destruction of t
the limb is a very constant one, and resem
upon the dorsum of the ilium. There is
inches; the thigh is strongly flexed, add
the foot is inverted; the trochanter lies
ilium, and is above Nélaton's line. In
come anchylosed. The displacement usua
sometimes so sudden as to be mistaken
the latter is exceedingly rare in the course

There is now marked atrophy of all t
thigh may be two or three inches smaller
all is usually allowed at the hip, but this is
by the exaggerated mobility of the lumbar
lordosis—is very marked both upon standi
of this stage may be several years. From
cur, often excited by falls, and accompanie
scesses. In protracted cases, all the soft pa
with cicatrices from old sinuses. After
third stage, cure can take place only by an

Diagnosis.—The important point in t
the hip, is the gradual evolution of the sy
of which are lameness, starting pains at n
functions of the joint. Mistakes in diagn
a failure to obtain a careful history, and f
symptoms of lameness and deformity. T
of the disease should constantly be borne
of cases, with a careful history, and a thor
but little doubt as to the diagnosis except
tion of obscure and irregular cases to those
small.

In the early stage, hip-joint disease may
the joint, with muscular rheumatism, polic
of the femur, phlegmonous inflammation

joint, or with caries of the lumbar spine. In the second stage there is even less difficulty in diagnosis, although abscesses resulting from perinephritis or appendicitis have been mistaken for those arising from hip-disease. In the third stage, a mistake is almost impossible.

Prognosis.—This is to be considered both with reference to life and limb. The records of the Hospital for Ruptured and Crippled show the mortality of hospital patients with hip-disease to be nearly 25 per cent. This includes deaths directly or indirectly traceable to the disease. The causes are nearly the same as in caries of the spine,—exhaustion from prolonged suppuration, amyloid degeneration, and general tuberculosis or tuberculous meningitis.

Under the most favourable conditions, the disease may be arrested in the first stage, and recovery occur without lameness or any noticeable impairment of the joint functions. This result, however, is not often obtained, because the disease is usually well advanced before it is recognised, or because of the difficulty in the way of carrying out all the details of treatment in the best possible manner. If the disease has advanced to the second stage, and suppuration has occurred, there always results some impairment of the joint functions; usually there are decided lameness and marked muscular atrophy, but very little shortening or deformity, provided the limb has been kept in the proper position. If the disease has advanced to the third stage, there are always marked shortening, deformity, and lameness.

Treatment.—The indications for constitutional treatment are the same as in caries of the spine. The purpose of local treatment is to secure constant and complete rest for the diseased parts, and to prevent deformity. Rest is secured by overcoming the muscular spasm by means of extension, by immobilizing the joint, and by transferring the weight of the body, in walking, from the hip to the perinæum. All these indications are now met, while the patient is up and about, by the use of the most approved apparatus. Formerly, rest and immobilization could be secured only by keeping the patient in bed, with the use of the weight and pulley. The general opinion of orthopædic surgeons at the present day is against excision, except in cases where, in spite of treatment by apparatus, the disease has advanced to the third stage, and in cases where life is threatened from prolonged suppuration and exhaustion. Under these conditions, excision should be performed; but early excision gives results very much inferior to those obtained by mechanical and constitutional treatment.

ARTICULAR OSTITIS OF THE KNEE—KNEE-JOINT DISEASE—WHITE SWELLING.—Ostitis of the knee usually begins in one of the condyles of the femur, the inner much oftener than the outer one; less frequently it begins in the head of the tibia. The pathological process is very much like that at the hip. There is in the first stage a central ostitis accom-

panied by infiltration and expansion o
The disease may remain limited to the
becoming encapsulated, or softening and
the formation of an abscess. Gradually
the periosteum and the soft parts are in
the joint itself in a destructive inflamma
without seriously involving the joint stru
joint is involved, varies much in differen
ple synovitis, a suppurative arthritis, o
and articular ends of the bones, synovi
that in the advanced stage all traces of a

If the process remains limited to tl
with very little impairment of the joint
joint has taken place, there will be mo
bony anchylosis. When there is destruct
ends of the bones, the limb assumes a ch
flexed, the tibia is displaced backward a
marked over-riding of the femur. Bo
often seen.

Symptoms.—The earliest symptoms
a slight stiffness of the joint, with a d
lameness. At first these symptoms are
they become constant and there is pain,
knee. In some cases there are "startin
are less constant and less severe than in
early, as the diseased parts are so supe
the bone itself; the condyle, usually the
gated, often to a marked degree, before t
parts. Later there is a general fusifor
joint and effacing all the normal outlin
sure over the bone affected is present qui
of the muscles of the thigh and calf.
rotated outward, the position which secu
of the joint structures. In some cases
swelling due to distention of the syno
form anywhere about the joint; very fr
tendon of the quadriceps extensor as
Gradually the deformity increases until
angle, and rotated outward over an arc o

The course of the disease resembles
spine. During periods of remission, pai
several months so completely as to lead t
has been arrested. An exacerbation is
of the joint, or it may follow an attack o

then progress rapidly and abscess after abscess form, with extensive destruction of all the joint structures and the production of permanent deformity.

Prognosis.—The danger to life is considerably less than in disease of the hip or spine. Death, however, results from the same causes—exhaustion, amyloid degeneration, and general tuberculosis or tuberculous meningitis.

With an early diagnosis and proper treatment the disease may, in a considerable proportion of cases, remain limited to the bone, and the resulting lameness and deformity be very slight; but otherwise a certain amount of lameness results from the stiffness of the joint. This may be due either to fibrous thickening or to bony anchylosis. Nearly all patients are able to walk without crutches, and if proper treatment has been carried out there is neither marked shortening nor deformity, although there is always great muscular atrophy.

Diagnosis.—The important symptoms for diagnosis, are the gradual onset, the early swelling which is due to enlargement of the bone, and the constant lameness and deformity. The disease may be confounded with rheumatism, with synovitis, and even with scurvy. In all these cases the resemblance exists only during the period of exacerbation. A careful history, however, will usually clear up the diagnosis.

Treatment.—The general treatment is the same as in other forms of joint disease. The indications for local treatment are the same as in hip-disease,—viz., to immobilize the affected limb and prevent deformity. This is accomplished by a form of apparatus which transfers the weight of the body from the joint to the perinæum, and which overcomes the muscular spasm which produces flexion and inward rotation of the joint. As in hip-disease, the results of mechanical and constitutional treatment are decidedly better than early operative measures; but late operations are indicated under the same conditions.

TUBERCULOUS OSTEO-MYELITIS.—This disease is rarely seen except in the short tubular bones, most frequently those of the hand and fingers. From this fact it is often called *scrofulous* or *tuberculous dactylitis*. It is described by many writers under the name of *spina ventosa*. Unger* gives the following figures showing the frequency with which the different bones were affected: fingers in 43, toes in 3, metacarpus in 41, metatarsus in 14, radius in 2, ulna in 2, tibia in 3, jaw in 3. The first phalanx of the index finger is the bone which is most frequently the seat of disease. In the majority of cases the process is confined to a single bone, although it is not rare to see five or six affected. In such cases the disease is seldom symmetrical. The process is a chronic inflammation, beginning in the centre of the bone with the deposit of tuberculous material. The swelling

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* Archiv für Kinderheilkunde, Bd. ii, 233.

which follows causes an expansion of th
until a mere shell may remain. The la
the periosteum and the soft parts, the for
necrosis, the exfoliation of sequestra, etc
one to three years, and causes in most ca

Tuberculous dactylitis is essentially a
seen most frequently during the second a
proportion of the cases there is a histo
usually exists as the only tuberculous les
it is associated with tuberculosis of the hi

Symptoms.—Tuberculous dactylitis us
ment of one of the phalanges, most freq
finger. It may be two or three months

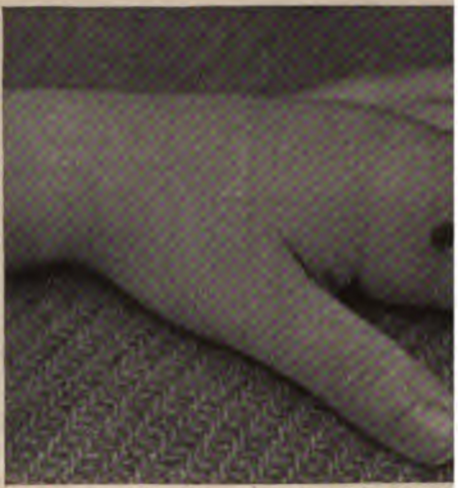

FIG. 146.—Tuberculous dactylitis of the fi

attract much attention. Exceptionally t
one, and is accompanied by both pain a
quite characteristic; it is smooth, hard,
shaped, involving the entire phalanx of t
ance of a severe typical case is shown in
ouration of the skin, and usually ther
generally opens at the side of the finger, a
the opening is enlarged by an incision th
with caseous matter, and dead bone is felt,
The cavity is surrounded by a thin shel
from the periosteum. If no operation is
weeks or months, other abscesses often

sequestra are exfoliated,—sometimes a single large one, which is the shell of the diseased phalanx almost entire.

In some cases the disease is arrested before necrosis occurs, but in the majority this is not so. After the wounds have all healed the finger remains shortened, deformed, and often useless. In some cases the disorganization is so extensive that amputation is necessary.

Diagnosis.—The recognition of dactylitis is usually easy, but as symptoms identical in almost every particular may be seen in a syphilitic inflammation, it is often difficult to tell with which of the two forms one has to deal. The tuberculous form is very much more frequent; it may occur in a patient with tuberculous antecedents, or it may be associated with other tuberculous lesions. Syphilitic cases are distinguished by the fact that the lesion is more frequently multiple, that it is often symmetrical, and that other manifestations of syphilis are generally present. It is affected by anti-syphilitic remedies, which is not the case in the tuberculous variety.

Treatment.—Painting with iodine and like measures are useless. The diseased part should be kept at rest,—if a finger, by the application of a splint. Every means should be taken to build up the patient's general health, as this is the most effective way to influence the local process. The general verdict of surgeons is against early excision as a means of arresting the disease. Abscesses should be opened early and freely, all diseased bone removed, the finger kept in proper position, and the wound treated according to general surgical principles. Under almost any treatment the disease is a protracted one, and rarely lasts less than a year.

THE SYPHILITIC DISEASES OF BONE.

The bone lesions of hereditary syphilis are not infrequent, but were long unrecognised, and have only within comparatively recent times been fully understood.* They may be divided into two groups,—those occurring with the early symptoms, and those which belong to the late manifestations of the disease.

Acute Epiphysitis.—This is the most frequent variety of bone disease in early hereditary syphilis. It may begin even in intra-uterine life, and it forms one of the most characteristic lesions of the disease. To some degree it is almost invariably present in syphilitic fœtuses and in syphilitic infants who are still-born.

In the early stage, there is an increase in the cartilage cells and delayed ossification. Later, a line of softening forms at the epiphyseal junction, which may cause loosening of the cartilages and ultimately complete separation of the epiphysis from the shaft, by the formation of granula-

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* See Taylor, Bone Syphilis in Children, New York, 1875; also G. Wegner, Virchow's Archives, Bd. l, Heft 3.

tion tissue between them. In cases rec
may take place with good union, perfec
formity. In other cases degenerative
with pyogenic germs may be added.
parts in the neighbourhood are now i
external abscesses; or the disease extend
rise to acute osteo-myelitis, which may le
joint may be invaded, causing an acute
This last result is more likely to occur w
within the joint cavity. The large joi

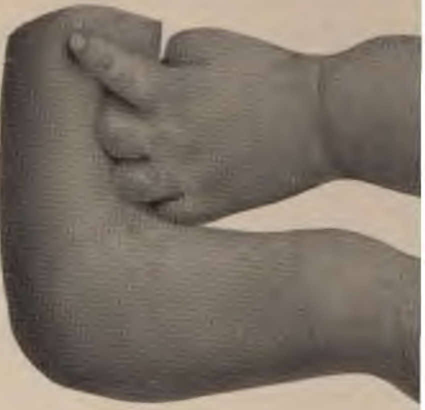

FIG. 147.—Syphilitic bone disease in a boy four years
arms is enlarged as a result of former epiphysit
over the metacarpal bone of the right thumb, an
The last two are recent lesions.

lesions are frequently symmetrical. Ac
cur independently of changes at the epi
seen in syphilitic infants they are to b
than of syphilitic origin. Secondary to t
are periostitis and inflammation of the sc
is rare in early infancy,

The bones most frequently the se
humerus, radius and ulna, although a
affected.

Symptoms.—The early symptoms are
during the first six weeks of life; the
festations of syphilis. In some cases th

the part of the child to move the limb, which may easily be mistaken for paralysis. It is, in fact, often described as "syphilitic pseudo-paralysis." The limb lies perfectly motionless, and any attempt at passive movement causes evident pain. There is tenderness on pressure and soon swelling is seen, both being most marked at the epiphyseal line. If the bone affected is superficially situated, as the lower epiphysis of the humerus, radius, or tibia, swelling is very apparent, while it may be scarcely perceptible at the upper epiphysis of the humerus. The swelling is usually cylindrical and moderate in degree, being limited to the extremity of the bone. In the more severe cases it may involve a great part of the limb. Abscess may form and separation of the epiphysis take place, so that crepitation may be obtained by moving the limb. Separation of the epiphysis not infrequently occurs even when there has been no suppuration.

In the milder cases, or those which have been subjected to active treatment, both the swelling and the tenderness subside rapidly without suppuration; and even though the epiphysis has separated from the shaft, it speedily unites. Where pseudo-paralysis has been the chief symptom, very rapid improvement occurs under treatment, and usually complete recovery of function in two or three weeks. If the disease extends to the joint, or if osteo-myelitis develops, the case is almost certainly fatal.

Diagnosis.—This is usually easy, from the age of the patient—generally under three months—the early prominence of pain and apparent loss of power, with the later appearance of swelling and signs of inflammation at the epiphyseal junction. In all these respects the disease closely resembles scurvy; but the latter is rare before the eighth or tenth month, there is usually a history of the long-continued use of some proprietary infant food, and it is cured by dietetic treatment alone.

The apparent loss of power may lead to the diagnosis of birth palsy, especially of the upper-arm type (page 110). The presence of acute pain and tenderness, the absence of the characteristic deformity, and the prompt recovery under constitutional treatment, usually make the distinction between the two conditions an easy one.

Treatment.—This is the same as in all early syphilitic manifestations, for which see the article on Syphilis. Locally, the part requires in the early stage only protection and rest. Should suppuration occur in the neighbouring joint, or should osteo-myelitis develop, these conditions should be treated surgically as they are when due to other causes.

CHRONIC OSTEO-PERIOSTITIS.—This is the usual form of bone disease which is seen in late hereditary syphilis, and it is one of the most frequent and most characteristic lesions of that stage of the disease. Occurring in adults, this would be classed as a tertiary symptom. Chronic syphilitic osteo-periostitis is rarely seen before the third year, and most of the cases occur between the fifth and fourteenth years. The most frequent seat of disease is the tibia, and next to this the bones of the forearm and the cranium. The following is the frequency with which the different bones were affected in the series of cases reported by Fournier:* tibia in 91 cases, ulna in 22, radius in 15, cranium in 16, humerus in 12, all others in 37. The process may result either in a diffuse or a localized hyperplasia of bone or in necrosis.

The typical changes are seen in the tibia. The shaft of the bone is principally or solely affected. There is often produced a very characteristic deformity, consisting of a forward curve of the anterior border of the tibia, which has been compared to a sabre blade (Fig. 148). In some cases the bone is bent inward at its lower third, resembling somewhat a rachitic curvature (Fig. 149). Sometimes the entire shaft of the bone is affected, and it may be enlarged to nearly twice its normal dimensions.

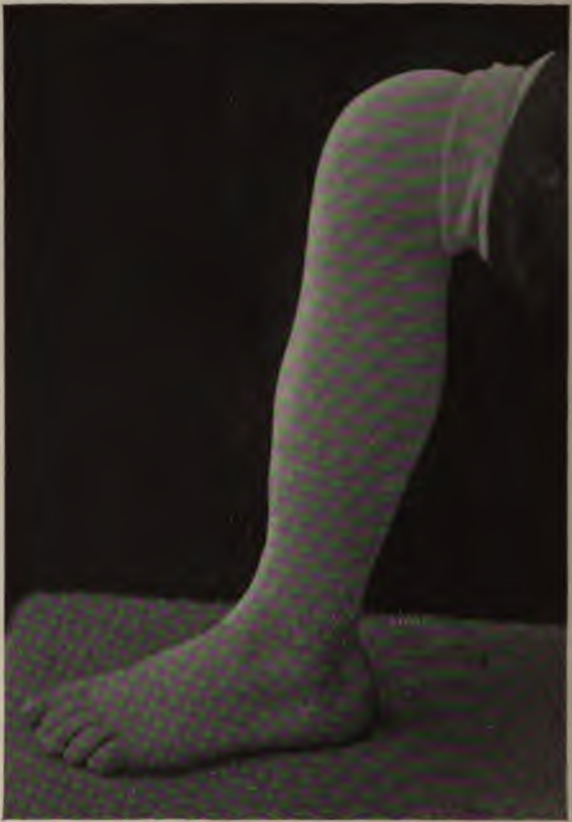

Fig. 148.—Syphilitic disease of the tibia, showing the sabre-like deformity, in a boy nine years old.

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* Syphilis Héréditaire Tardive, Paris, 1886.

At other times the swelling is chiefly near the epiphysis, where large bosses may form of sufficient size to interfere with the functions of the joint. Instead of affecting the bone uniformly, the disease often affects only certain parts, leading to the formation of large nodes which are more likely to be followed by necrosis than are the other lesions. In most of the cases the process is purely a hyperplastic one, leaving the bone permanently enlarged. Less frequently, there occur gummatous deposits in or beneath the periosteum, which may soften, suppurate, and lead to superficial necrosis, with the formation of sinuses that remain open until the sequestrum is exfoliated (Fig. 150). Syphilitic deposits sometimes take place in the interior of the bones, generally near the articular ends; these may soften and break down with abscesses, sinuses, etc., very much after the manner of a tuberculous inflammation (Fig. 147).

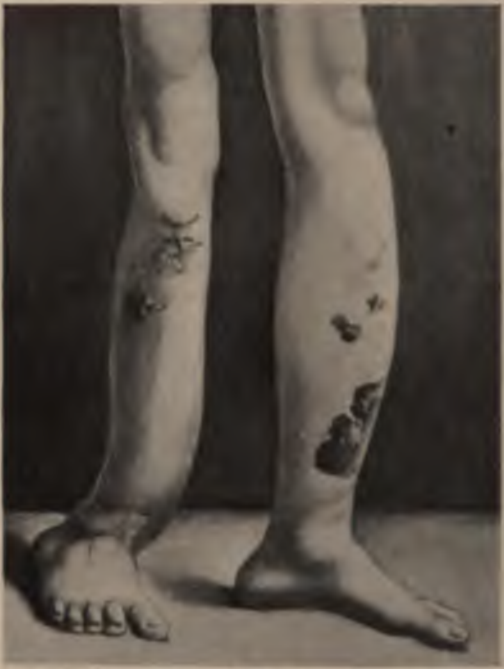

FIG. 149.—Syphilitic disease of both tibiæ. The left shows a general enlargement of the bone, the characteristic curve of its anterior border, with ulcers due to necrosis. The enlargement of the right tibia is less marked, and there is a pseudo-rachitic curve at its lower third. Cicatrices near the knee mark the site of former ulcers. (After Fournier.)

The lesions of the other long bones are essentially the same as of the tibia. They are nearly always symmetrical and often multiple. In a case recently under observation in a boy of four years, the disease involved both tibiæ, both radii, the right ulna, the left metatarsus, and the metacarpal bone of the left thumb. The course of syphilitic osteo-periostitis is very chronic, and some permanent deformity is the rule, unless cases come very early under treatment.

When affecting the bones of the cranium the disease usually takes the form of a gummatous periostitis, which leads to the formation of large nodes. These may remain as permanent deformities, or they may break down and suppurate, with necrosis of one or both tables of the skull. This may be followed by inflammation of the dura, the pia, and even of the brain itself.

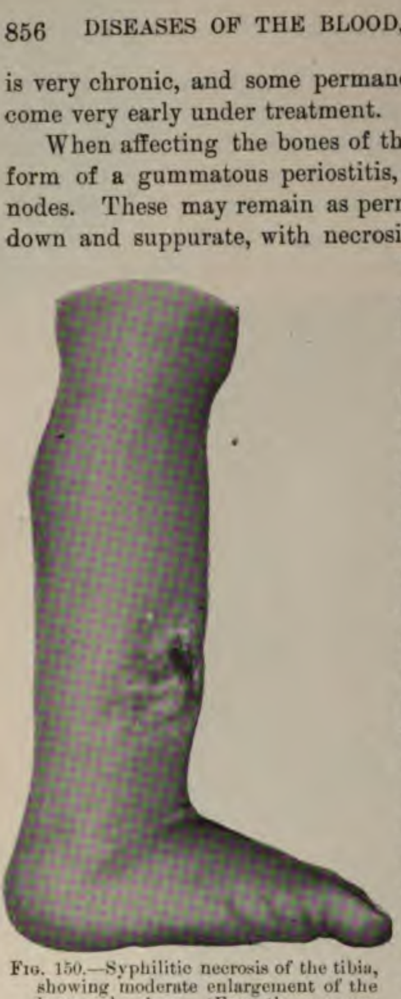

FIG. 150.—Syphilitic necrosis of the tibia, showing moderate enlargement of the bone and a sinus. (From the same patient as Fig. 147.)

Symptoms.—When the long bones are affected, the symptoms are pain, tenderness and deformity. These come on very gradually, and often the deformity is noticed before either pain or tenderness is sufficiently marked to attract attention. The pain is regularly worse at night, and often felt only at that time; it may be mild and occasional, or so severe as virtually to prevent sleep. There is tenderness on pressure over the bones affected, the acuteness of which will depend upon the activity of the process. When suppuration occurs, it comes very slowly, and never with symptoms of acute inflammation. Sinuses usually continue to discharge until a sequestrum is exfoliated. The course of the disease is very tedious, and the whole duration is usually several years.

When the cranium is affected, there are seen the irregular nodes, especially upon the frontal and parietal bones. They are from one to two inches in diameter, and project from one eighth to one fourth of an inch above the general outline of the skull. There may be pain, tenderness, softening, suppuration, and necrosis, as in the long bones.

Diagnosis.—It is so very rare that disease of the bones of the cranium is due in childhood to any other cause than syphilis, that this disease may always be assumed to exist if traumatism can be excluded. The bosses upon the cranium in rickets (page 226) are always large, smooth, and regular in position, and belong to infancy.

Syphilitic disease of the long bones is recognised by the nocturnal pain, the tenderness and peculiar deformity, and by the association of other late manifestations of syphilis,—i. e., the peculiar notched teeth, the interstitial keratitis, the enlarged epitrochlear glands, etc. Tuberculous disease generally affects the articular ends of the bones; syphilis nearly always the shaft. The diffuse hyperplasia of the tibia and the sabre-like deformity of its anterior border, are rarely if ever due to any other cause than syphilis.

The deformities of the long bones have in some cases a certain resemblance to those due to rickets, but on close examination there are seen striking differences. The epiphyseal enlargement at the wrist in rickets affects both bones (Plate V, page 222); in syphilis it is usually of one bone only (Fig. 147). The differences between rachitic curvatures of the tibia and the deformities from syphilis may be readily seen by comparing Figs. 38, 39, and 40 (pages 227 and 228) with Fig. 149.

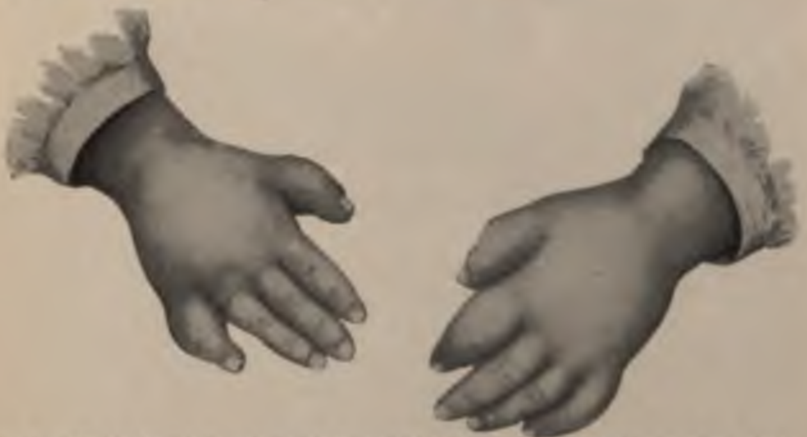

FIG. 151.—Multiple syphilitic dactylitis, in a child two years old. The disease affects the first phalanges of both thumbs, both little fingers, and the index finger of the left hand.

Treatment.—The constitutional treatment of these lesions is the same as that of the other late manifestations of syphilis,—mercury and the iodide of potassium; for details, see the chapter on Syphilis. Surgical treatment is required in cases which terminate in necrosis, whether of the cranium or the extremities. They are to be managed like the same conditions in adults.

SYPHILITIC DACTYLITIS.—This belongs to a somewhat earlier period of syphilis than the disease just described, and is usually seen in children under five years old. It is not a frequent manifestation of syphilis, and as compared with tuberculous dactylitis it is rare. It was first fully described by Taylor (New York). The symptoms closely resemble the tuberculous form. It may begin as a periostitis but more frequently as an osteo-myelitis. Like the tuberculous form it usually goes on to suppuration and necrosis. According to Taylor, dactylitis is more often single than multiple, but in my own cases several phalanges have generally been

involved, and the lesions have often been
case, the first phalanx of every finger of b
curred in a child nine months old who w
years, and who presented during this p
reditary syphilis.

The symptoms and course of syphil
same as in the tuberculous form. The d
with the latter disease (page 851). The
the two varieties, with the exception that
cases may often be arrested by constituti
as in other late lesions of syphilis. The
employed as in the tuberculous cases.

CHAPTER

DISEASES OF T

THE skin at birth is covered with
vernix caseosa. The skin itself is of a de
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the same tint. This excessive redness slo
at the end of which time the skin has ass
On the third or fourth day there are usua
this generally fades by the end of the sec

The epidermis which is present at b
off. This normal desquamation usually
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oiled and properly bathed, desquamatio
close examination is made. In some infa
cate and cachectic, it is very much mor
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a condition which is regarded by Kapo
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that due to hereditary syphilis; the latte
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Perspiration is rarely present before t
is then seen only upon the forehead. I
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a symptom of rickets; less marked persp
eral weakness or during acute illness.

CONGENITAL ICHTHYOSIS.

Congenital, or more properly fœtal, ichthyosis, sometimes known also as diffuse keratoma, is a rare disease, characterized by the formation, usually all over the body, of a thick, horny epidermis resembling parchment. This is divided by fissures or shallow furrows into irregular patches; sometimes these are two or three inches wide, at others as small as a pin's head. The disease begins in the early months of fœtal life, and is an abnormality in the development of the skin, there being an excessive proliferation of the layers of the epidermis.

Symptoms.—In the gravest form of the disease the child often lives but a few hours, and rarely more than a week. The openings of the nostrils and the ears may be occluded by the excessive production of epithelial cells. The eyes are in a condition of ectropion, and there are often deformities of the mouth and other orifices due to the contractions of the skin. The nails and hair are usually imperfectly developed. The body seems incased in a hard, horny covering, and looks as if it had been varnished or covered with collodion. The skin cracks or splits and the edges curl up, an appearance which has been aptly compared to the skin of a boiled potato.

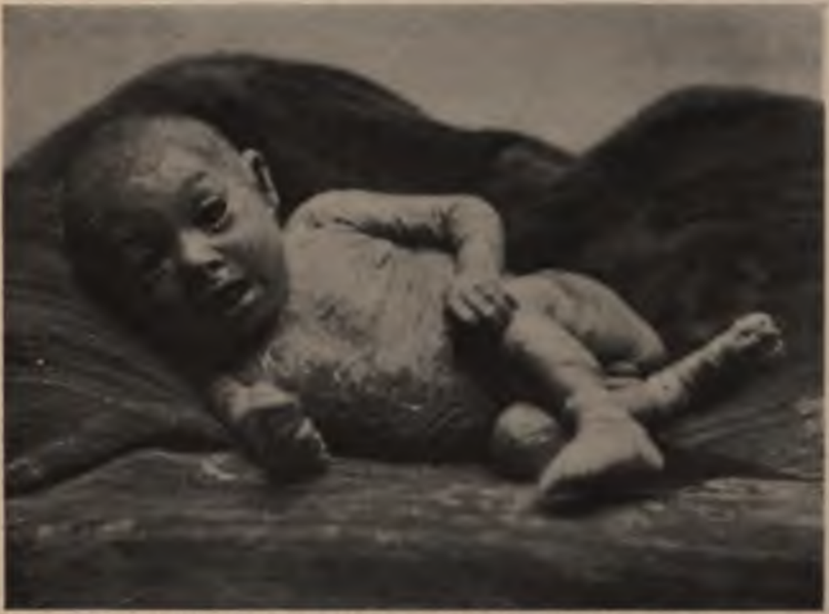

FIG. 152.—Congenital ichthyosis in a child ten months old. The large scaly patches are well shown on the lower part of the right chest and abdomen, and the constricting bands upon the legs. (From a photograph by Dr. Cabot.)

In the milder form, the duration of life is indefinite, depending upon

the degree of development of the disea
are frequently seen the deformities at t
may also be a continued exfoliation of
patches. After this has separated, the sk
but gradually becomes dry, hard, and s
splits in various directions. In a case
Babies' Hospital,* a picture of which is
tration (Fig. 152), it was stated by the
months of life complete exfoliation of th
of every two or three months.

The outlook is bad in all cases; in
occurs in infancy, but in some of the mi
throughout childhood. The "alligator
example of this class.

Treatment.—The indications are to
the use of oils, continuous baths, etc., an
cleanliness. Although a certain amount
these measures, a cure is not to be expect

MILIARI

The term miliaria is applied to an
which may occur either with or without
matory form is known as *sudamina*, the
rubra, *miliaria vesiculosa*, and *miliaria*

Sudamina.—In this form there is no
according to Crocker, are blocked by an
while no perspiration is going on; and w
fluid, being unable to escape, accumulat
These appear like small pearly bodies
the course of a few days by absorption.
to time. Sudamina may be seen in any
hausting diseases. It requires no treatm

Miliaria Rubra.—This condition, also
etc., is a sweat rash, usually seen in youn
ive clothing. It is most frequently obse
often upon the side of the face upon whi
held against the mother's body while nu
one breast. The eruption consists of s
with tiny vesicles. Miliaria rubra is an

---

* This case has been fully reported by Cabo
1895. For fuller description of the disease, see
ii, 1895; also Archives of Pædiatrics, April and

glands, the result of which is a retention of their secretion. There is generally little or no itching. The treatment consists in the removal of the cause, and the application of some absorbent powder, such as boric acid and starch.

Miliaria Papulosa (Lichen Tropicus, Prickly Heat, etc.).—This is the most common and most important variety of miliaria. There is in this disease an obstruction of the sweat glands by inflammatory products. The lesion consists in the formation of bright-red papules, which are very closely set, the summits of some of them being surmounted by tiny vesicles, and here and there in severe cases even small pustules may be seen. If not interfered with by scratching, the vesicles dry up without rupture, and are followed by a slight desquamation. Where there is much scratching, an eczematous condition may result. Miliaria papulosa comes out with great rapidity, especially upon the neck, forehead, back, and chest. It is accompanied by an almost intolerable itching and stinging sensation. Over other parts of the body profuse perspiration occurs. The disease is produced by very hot weather and excessive clothing. Although the duration of a single attack is but two or three days, in susceptible patients it may keep recurring for weeks, being exceedingly intractable. Where there is much scratching the resulting eczema is very troublesome. It is not infrequently followed by furunculosis.

The diagnosis of miliaria rubra and miliaria papulosa is usually easy. They are distinguished from eczema by the suddenness with which they appear, by the associated sweating of other parts of the body, by the transitory character of the eruption, and by the fact that the rash never occurs in circumscribed patches. Prickly heat sometimes resembles the rash of scarlet fever, but the fact that the tiny papules are in some places crowned by vesicles and that constitutional symptoms are absent, usually make the distinction an easy one.

Treatment.—Prickly heat is to be prevented by light clothing, frequent bathing, and the plentiful use of a good toilet powder, such as boric acid and starch. During an attack, the bowels should be freely opened by calomel or a saline, and secretion of the kidneys stimulated by the use of nitrate of potassium or the sweet spirits of nitre. The skin should be protected against the irritation of flannel undergarments by the interposition of silk or linen. When the inflammation is at its height, relief is obtained by the application of a calamine and zinc lotion (page 869), or by a dilute solution of the acetate of lead; carbolic acid may be added to either, where the itching is intense. In some cases powders are preferable to lotions. One of the best is the stearate or the oxide of zinc, twelve parts; bismuth, three parts; powdered camphor, one part; or equal parts of starch and boric acid may be used, or simply rice flour. All of these must be very freely applied. The diet should be light and fluid, and if milk is the food it should be considerably diluted.

SEBORRH

Seborrhœa is considered by dermato
disease of the sebaceous glands; althoug
inflammatory, and classes them as sebo
sitic origin (page 865). The disease m
body, and children of any age, but the
is seen upon the scalp in young infan
variety, and the only one which will be h

Seborrhœa of the scalp is character
vertex, of dirty-yellow crusts, which are
are composed of epithelial cells, fat-globu
is always added dirt. In neglected cases
by a dense crust, which may be as thic
crusts are removed the underlying scalp
but more frequently, in cases of long s
eczema is set up by the decomposition of
to remove the crusts by such means as th
employed in domestic practice. There
improvement or recovery, and the conditio
seborrhœa should be treated, for when ne
soil for the development of eczema.

Treatment.—Only local measures are
be softened with oil, and then removed by
water and soap, after which an ointment
aquæ rosæ, ℥j) or sulphur (precipitat
should be applied. The oil and soap and w
or as often as the crusts form. In the
ered with the ointment.

ECZEMA.

Eczema may be defined as a catarrha
is the most frequent and altogether the m
in early life. The scope of the present w
such features and varieties as are peculiar
The eczema of older children does not dif
that of adults.

Etiology.—The conditions in infancy
first, that the skin is extremely delicate, an
external irritants and micro-organisms; se
lar activity. While all children are susc
in whom the susceptibility is very mark
amount of external irritation, or the mos
tion may produce a severe eruption. It w

eczema of the face and scalp among the manifestations of infantile "scrofula." It is true that certain infants are prone to eczema, as others are to catarrhal processes of the mucous membranes, but no more can be positively affirmed. We certainly can not connect eczema with any single diathetic condition; but it is much more often seen in children with gouty antecedents than in others; or to state it differently, the most frequent manifestation of gout during infancy is the tendency to eczema. Children of rheumatic families are also prone to the disease. Eczema of the face is common in fat, healthy-looking infants, and is seen both in those who are nursing and in those who are artificially fed. It also occurs in flabby, poorly nourished children, but rarely in those suffering from marasmus.

The exciting causes of eczema may be external or internal. Of the former the most important are heat, cold dry air, and winds—as in the familiar chapping of the face—the use of hard water or of strong soaps in bathing. The disease may be due to the irritation of clothing, to want of cleanliness, or to irritating discharges from mucous surfaces, as in the eczema of the upper lip, thighs, or buttocks. It accompanies most of the parasitic skin diseases, particularly pediculosis, scabies, and ring-worm. It is probable that in many forms of eczema micro-organisms play an important part; even though they may not have been the primary factor in causing the disease, they may suffice to continue the inflammatory process.

The internal causes of eczema are chiefly associated with deficient elimination from the kidneys and bowels, and digestive disturbances. It often accompanies chronic constipation where there is intestinal torpor and the white stools of deficient biliary secretion; and it is seen where the urine is scanty and concentrated because children partake too largely of solid food. The latter is true both in the first and second years.

Eczema may be produced by any form of digestive disturbance, but it is especially frequent in the intestinal indigestion which results from overfeeding, or the too early or excessive use of farinaceous food, or from breast milk in which the percentage of fat is very high. From personal experience in the post-mortem room, I can confirm the observation of Bohn regarding the frequency with which fatty liver occurs in very fat infants. Enlargement of the liver may sometimes be made out during life. It is highly probable that the interference with the hepatic functions which accompanies these fatty changes has much to do with the production of eczema in such subjects. In children fed upon cow's milk the excessive fat may be the cause, or it may be due to excessive proteids. Of farinaceous articles, the two which are most often to be blamed are potato and oatmeal. Although eczematous patients usually appear to be well nourished, it is rare that some symptoms of indigestion are not present.

Eczema is often due to some form of reflex irritation. Such are the cases which accompany dentition, and the rare ones due to genital irrita-

tion. By many writers the eczema cause
intestines is regarded as reflex. The stro
trivial is the reflex irritation which will i

Simple Chronic Eczema—Eczema Ru
form of eczema occurring in infants an
seen upon the face. It affects by prefe
scalp, not infrequently the ears and nec
of the body. Upon the trunk and extr
patches, but in rare cases may cover nea
generally begins upon the cheeks with th
later these coalesce, and there is a mois
sero-pus. The secretion dries and forms
be so hard as to form a mask for the fa
by the almost intolerable itching, the su
blood gives to the crusts a dirty-brown c
appearance. The skin is often much s
crusts there is seen, in acute cases, a re
charging pus or serum and bleeding re
active, there are redness, thickening, ind
and marked itching. In the same case t
bations occurring whenever the exciti
From the cheeks the disease spreads to
here similar lesions are seen. Upon the t
rarely form, but the skin is red, thick, a
affected are the forearms, chest, elbows,
sionally the eruption is general.

Swelling of the lymph nodes in the n
constant feature of eczema of the face
size of a chestnut or walnut, and occas
itching is a characteristic feature of all
scalp. It causes restlessness and loss
this way that the disease affects the gen
most cases the health remains good. W
of the scalp, pediculosis is usually associa

Eczema of the face is very chronic,
with great difficulty. There is a strong
by neglect of local treatment or by any d

The predisposition to eczema often c
who have suffered from it almost const
from it during the remainder of childh
plained by the loss of fat in consequen
diet which is more largely nitrogenous
through the third and fourth years, the
obesity—is not infrequently present.

Seborrhœic Eczema.—This form of eczema has been brought into prominence by the writings of Unna, according to whom not only are all the cases usually classed as seborrhœa to be regarded as eczematous, but also many others classed as ordinary eczema. Instead of seborrhœic eczema being a form of disease in which the fat-producing glands are involved in the inflammatory process, Unna believes it to be parasitic and due to a certain "mulberry coccus" which he has described. Although his investigations have not yet been corroborated, there are many arguments in favour of the pathology which he has advanced for this disease. Elliot, who accepts Unna's views, defines seborrhœic eczema as follows: "An inflammatory disease of the skin, catarrhal in nature, due to micro-organisms—a parasitic dermatitis—characterized by its primary seat being upon the scalp, whence it tends to spread downward, involving by preference the middle portion of the face, the sternal and interscapular spaces, axilla, and inguinal regions, but may affect any part of the body." * The lesions upon the scalp may be of the nature of a dry seborrhœa with yellow greasy crusts, or like pityriasis. Upon the body, the eruption is scaly, with red macules or papules, or it may be accompanied by greasy crusts like those seen upon the scalp. The skin is not usually thickened and the lesions are not elevated. Itching in most cases is only moderate, and it may be absent; but in some of the most severe cases it is marked and accompanied by tingling. An extensive weeping surface is never seen. All the crusts are soft and contain fatty matter. The lesions are not deep, and the disease frequently shifts from one part of the body to another, often coming out very rapidly. In most cases the patches are rather sharply defined and have rounded borders.

Pustular Eczema of the Scalp.—This condition, often called "simple impetigo," is less frequently seen in infants than in children from two to five years old. There are usually present from half a dozen to fifty greenish-yellow crusts, matting the hair, usually discrete, but sometimes coalescing to form a mask over half the scalp. There is very little itching, in some cases none at all. The lymph glands are invariably enlarged. There is frequently continued auto-infection, and in this way the disease may be prolonged indefinitely. It is possible, too, that infection may spread to other children.

Intertrigo.—This term is rather indiscriminately applied to any eruption which develops upon two moist surfaces, which are in contact. It is often regarded as a form of eczema, although, as Elliot has well pointed out, there are seen several processes which are quite distinct from one another. The most frequent is a simple erythema; in other cases there is an eczema resulting from traumatism or the decomposition

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* Morrow's System of Genito-Urinary Diseases, Syphilology, and Dermatology, vol. iii, D. Appleton & Co., 1895.

of secretions, or a seborrhœic inflamma
folds of the groin, between the scrotum
tocks, about the anus, in the axillæ, in t
essential causes are moisture, friction, w
infection. The disease is generally se
thighs, genitals, and buttocks; it somet
tends down to the middle of the thigh
redness, and in some cases the epidermis
the surface is moist. There is no thick
Intertrigo is usually easy to control ex
marantic children, among whom it is esp

Diagnosis of Eczema.—This is usual
majority of cases, the disease affects the
ances are typical. Eczema of the body c
with scabies or syphilis, and occasionally
Scabies resembles eczema in its intense
but in the former, one may often find e
members of the family; the parts most f
of the wrists, the elbows, the skin betwee
axillæ, the lower part of the abdomen a
and by careful examination with a lens s
are certain to be discovered.

Syphilis is likely to be confounded
tocks. The latter affects the parts near
lead to the development of spots closely
local appearances may at times be indist
diagnosis is to be made only by the othe
the characteristic eruption is seen usuall
sometimes the palms and soles; there i
dence of inflammation; the eruption is
circumscribed spots; there are usually
the coryza, the syphilitic cachexia, and e

The diagnosis from pediculosis and
sents any difficulties.

Prognosis.—All cases of chronic ecz
slight tendency to spontaneous improve
ous recovery during infancy. In a given
the duration of the disease, its severity,
tion of the mother or nurse. The r
upon the particular line of treatment ad
ried out. Usually it must be continued
the face is especially intractable when oc
chronic indigestion and constipation, fo
controlled by diet and general manage

temporary relief. Intertrigo is in most cases easily cured, unless the patient is suffering from marasmus.

Treatment.—It is never dangerous to cure an eczema, and always desirable to do so, in spite of the strong prejudice to the contrary, which still exists in the minds of the laity and in some members of the medical profession. To treat eczema successfully there is required a careful study of the exciting cause, for, although improvement often results from the use of local measures alone, yet in the great majority of cases this is only temporary. A permanent cure is brought about only by the removal of the cause. The physician must first endeavour to decide whether the eczema is due to some external or internal cause, or to both. External causes are for the most part easily discovered by carefully questioning the mother and observing how the child is cared for. Internal causes, as before stated, usually relate to the digestive tract or to functional disturbances of the kidneys.

Diet.—A thorough investigation into the food is necessary, not only as to its character, but as to quantity and preparation, the manner and frequency of feeding, etc. If the patient is a nursing infant, an examination of the nurse's milk is indispensable to intelligent treatment. If the child is very fat and well nourished, it is generally the case that the fat of the milk is too high and must be reduced according to the rules given elsewhere (page 164), the most important thing being to exclude from the nurse's diet malt liquors and alcohol in all forms, and reduce the amount of meat. In a smaller number of cases the trouble is with the proteids of the milk; there will then be other signs of indigestion, such as colic, the appearance of curds in the stools, etc. The amount of food should be reduced by lengthening the period between the nursings, and shortening the time which the child is allowed to remain at the breast at one nursing. Plain water, or better, some alkaline water, should be given freely between the nursings. In children fed upon cow's milk, the trouble is probably more often with the proteids than with the fat. The physician should try the effect, first of giving a milk which is low in proteids and moderately high in fat (e. g., formula iii or iv, page 175) afterwards, one in which both fat and proteids are low (e. g., formula xv or xvi, page 176). These and other changes are to be made in the manner described in the chapter on Infant Feeding (pages 175–182). During the latter part of the first and the entire second year, the usual error is that of overfeeding with in most cases an excessive use of solid food, especially farinaceous articles. The diet should then be much reduced, and the amount of farinaceous food restricted, potatoes and oatmeal being absolutely prohibited. The diet which suits most children best is one composed of milk, beef juice, broth, fruit, eggs, and a little red meat, with the addition in some cases of rice, wheat, or barley. In severe and obstinate cases, however, all cereals and even meat are best omitted during the active stage of the

disease. The form of indigestion which
to the special indications in each case.

The diet of older children needs to
that of infants. The general rules laid
the second year (pages 188–190) should
of cases do best upon a diet which is la
pally of milk or some of its substitutes,—

Elimination by the kidneys should be
water, to which it is well to add—especial
—the citrate,* or acetate of potassium, f

Attention to the condition of the bow
To overcome the tendency to constipati
eczema. Suggestions under this head
Chronic Constipation (page 374). Spec
to the occasional use of a purge of calo
given every third or fourth night. The
over-fed children. It has a favourable e
upon the bowels. The bowels must not
freely open by the daily use, if necessary,
such as phosphate of sodium, rhubarb,
acts so well as castor oil, which may be
to teaspoonful doses every night for tw
should be administered in emulsion.

When the disease occurs in flabby, a
dren, iron and bitter tonics are required,
liver oil. In other words, the child's gen
just as if no eczema existed. Theoretica
disease is in a chronic stage with dry, sca
disappointing in infancy. It is in no sen

The *general management* of cases is
carefully protected by an ointment when
if the weather is very cold, or there are
eczema should not go out, but take the
an eczematous surface be washed with
castile soap and water, so frequently em
washing is necessary, it may be done w
or starch and water, to which borax (a t
added. The clothing should not be so e
stantly in a perspiration. Napkins shou
solutions, nor, in case of eczema of the
second time after being simply dried.

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* While the citrate can not be depended up
a newly-opened bottle, it is generally to be prefer

In eczema of the face it is absolutely necessary to prevent the child from scratching the parts. The use of a mask is not always sufficient, nor the wearing of mittens; nor is the local application of anti-pruritic lotions or ointments invariably successful. In severe cases mechanical restraint is absolutely indispensable. The most satisfactory method is to surround the arms at the elbows by pasteboard splints, and hold them in place by bandages. This allows free use of the hands, but makes it absolutely impossible for the child to reach the face.

Local treatment.—Local treatment is always necessary, for not only are the causes sometimes entirely external, but the condition may persist after the original internal cause has been removed. There are several indications to be met by local treatment at different stages in the disease: (1) To remove crusts and other inflammatory products; (2) to allay congestion and acute inflammation; (3) to relieve itching; (4) to protect the delicate new skin which is forming; (5) to prevent infection; (6) to stimulate the skin in the chronic stages of the disease.

Preparatory to the use of any application, the scales, crusts, and other products of inflammation must be softened and removed in order that the diseased surface may be reached. In most cases it is sufficient to soften the crusts by the use of olive oil for twelve or twenty-four hours, and then remove them by soap and warm water. If the crusts are very hard and thick, they can be softened by a poultice. During the stage of acute inflammation only sedative applications should be used. One of the best of these is a lotion of zinc and calamine:

℞ Pulv. calaminæ preparatæ	ʒ ij
Zinci oxidi	℥ ss.
Glycerinæ	℥ j
Liquor calcis	℥ ij
Aquæ rosæ	℥ viij.

A piece of muslin should be dipped in this solution, and applied to the affected part, being kept in place by a bandage. If there is much itching, one per cent of carbolic acid may be added.

Another plan of treatment, where there is much secretion, is to keep the surface covered with equal parts of boric acid and starch or the stearate of zinc. An application which is often successful in allaying the intense burning and itching is black wash. This is applied with absorbent cotton for ten or fifteen minutes several times a day, and allowed to dry on, after which a protective ointment is used. If the black wash in full strength is painful, it may be diluted with water. Ichthyol may be used in the same way, but only in dilute solution—i. e., from one half to one per cent.

As a simple protective ointment to follow any of the above, one containing starch, zinc oxide, or bismuth, either alone or in combination, may be used. An excellent formula is Lassar's paste:

℞ Acidi salicylici........................
Zinci oxidi.............. ....
Amyli.................................
Vaseline..............................

Later, when the inflammation is les
nothing is so generally useful as a con
the following:

℞ Ungt. picis liquidæ..................
Zinci oxidi...........................
Ungt. aquæ rosæ......................

For more chronic cases, the amount
ointments used should be spread upon n
with the inflamed part by means of a ba
ing is accomplished by simply rubbing t
part. Where it is difficult to keep a
where it is impossible to use the ointment

℞ Pulv. tragacanthæ...................
Glycerinæ............................
Aquæ rosæ ....

To this may be added zinc oxide gr. xl an
A similar basis for ointments, made from
gested by Elliot and is known as bassor
with tar, zinc, salicylic acid, or resorcin.

The methods of treatment above men
to eczema of the face and scalp. For pu
best application is the white-precipitate c
bined with three or four parts of vaseline.
eczematous patches upon the body, but it
surface.

In intertrigo, the treatment should ha
condition which is present. Cases of
promptly to cleanliness and the free use o
such as boric acid and starch in equal part
titis, the calamine and zinc lotion may be
ointment. When infection has been add
thyol, one half or one per cent strength,
skin then covered with the powder mentio
often as the parts are wet by urine or so
in all cases that the diseased surfaces sho
best done by starch and absorbent cotton.
diately removed when soiled. Other usefu
and Pick's paste combined with zinc oxide

In cases of chronic eczema, where the

scaly, and itching, stimulating applications are to be used, such as the tincture of green soap or stronger preparations of tar than those mentioned. They should be applied every three or four days.

In the seborrhœic form of eczema, whether affecting the face, scalp, or body, nothing is so generally useful as resorcin:

℞ Resorcin	gr. x
Ungt. aquæ rosæ	℥j

This may also be advantageously combined with bassorin paste.

FURUNCULOSIS.

A furuncle, or boil, is a circumscribed inflammation of the subcutaneous cellular tissue, beginning in a hair follicle, sweat gland, or sebaceous gland, and usually ending in suppuration. When severe, it may result in necrosis of the follicle, which forms the "core," or the necrotic process may extend to the surrounding tissues for a variable distance. The ordinary boil need not be described, as it presents nothing peculiar in early life. The condition, however, which is characteristic of young children is the formation of small ones in great numbers. It is to this more especially that the term *furunculosis* is applied. The principal seat of these small abscesses is, in nearly all cases, the scalp, face, and shoulders, although they may be found upon any part of the body. They are sometimes numbered by hundreds, and appear in crops for a period of several months. In size, they usually vary from a pea to an almond, and they rarely contain a core. Infants are much more often the subjects of this disease than are those who have passed the second year. In the great majority of cases the condition is not serious, yet, occurring, as it often does, in infants who are already suffering from extreme malnutrition or marasmus, whose tissues possess but little resistance, the process may develop into a gangrenous dermatitis, which may prove fatal.

Furunculosis is seen in children who are in other respects apparently healthy, even robust; but the majority are in a more or less debilitated condition, and often are the subjects of digestive disturbances. The disease is quite frequent in syphilitic infants; but these simple abscesses are to be sharply distinguished from those which result from the breaking down of gummata of the skin. Want of cleanliness of the skin is a factor of some importance in producing the disease. Furunculosis may be associated with eczema. The exciting cause in all cases, as shown by the recent investigations of Escherich and others, is the entrance of pyogenic germs, usually the staphylococcus aureus, into the follicles of the skin.

Treatment.—The internal treatment is to be directed toward any disturbance of digestion or general nutrition which is present. General tonics are indicated in most cases, particularly iron, arsenic, and the compound syrup of the hypophosphites. But little reliance can be placed

upon internal remedies, such as sulphide
arresting this disease. Local treatment
thorough cleanliness of the skin. This is
ing the parts affected with a saturated
furuncles may often be aborted by the fr
camphor, or a few applications of tincture
with pure carbolic acid. The last mention
be intrusted to the hands of a mother or
used with considerable success is a plaste
perience the best plan of treating the mul
incision until they have pointed, then to in
completely by compression. It is then
solution of bichloride (1 to 2,000), and sm
applied till the bleeding has ceased. After
with simple collodion or that in which iodo
the abscesses are of large size and upon th
pression by applying a snug bandage for a
abscesses so treated to refill. When the s
there is necrosis of the cellular tissue, icht
ointment or lotion (one to five per cent str
cations. Early and free incisions must be

GANGRENOUS DER

This is not a frequent disease, and is
fancy. It may be primary or it may follo
been described under many different nam
ecthyma gangrenosa, pemphigus gangrenosa

The lesion consists in small, discrete are
ending in necrosis. In the primary cases t
cle, about as large as a pea, with a dusky a
becomes a pustule. Crusts form which a
moving them a loss of tissue is seen. The
not undermined edges, often presenting
By the coalescence of several small ones, ul
ter are sometimes formed.

The primary form of gangrenous dermat
nourished infants, and, according to Elliot,
buttocks. In this location it may be mista
ary form is more common, and usually fol
vaccinia, measles, or pemphigus. My own e
been confined to cases following varicella.
seen upon the upper half of the body, espec
It follows the ordinary lesions of varicella a

of treatment, from one to four weeks, in most cases ending fatally. The disease always occurs in infants of poor vitality, often in those suffering from marasmus, and is seldom seen outside of institutions. It may be accompanied by fever, and other severe constitutional symptoms.

For the production of the disease, two factors are necessary: first, the constitutional condition referred to; and, secondly, the entrance of pyogenic germs, usually the streptococcus pyogenes.

Treatment.—Every means possible should be employed to build up the general health of the infant by tonics, fresh air, careful feeding, etc. Locally, strict cleanliness and antiseptic applications are necessary. The best application is a solution of bichloride (1 to 5,000), or an ointment of ichthyol or iodoform.

IMPETIGO CONTAGIOSA.

Impetigo contagiosa is a disease characterized by the formation of discrete vesiculo-pustules, occurring most frequently upon the hands and face. Cases are usually seen in groups affecting several children in one family or institution. It may be communicated from one person to another, and spread by auto-inoculation from one part of the body to another.

One rarely has an opportunity to see the disease until vesicles have formed. These are usually from one fourth to one half an inch in diameter, and are flaccid, never distended. Later, their contents become slightly yellowish; then they rupture and dry, forming thick yellow crusts, which have the appearance of being "stuck on," the surrounding skin being quite healthy. After the crusts fall off, a small red patch remains, which slowly fades. The true skin is not involved, except in poorly-nourished, cachectic subjects, as a result of continued local irritation, like scratching. Under such conditions ulceration may occur. Instead of the small vesiculo-pustules described, bullæ from one to two inches in diameter may form, filled first with serum, afterward with sero-pus. Very little inflammation is seen about these patches, and in most cases the intervening skin is normal.

The favourite seat of the eruption is the face, especially about the chin, next the hands, the neck, the feet and legs, the forearms, and the scalp; it is rarely seen upon the abdomen, and never upon the back. There may be only half a dozen vesiculo-pustules, or from thirty to forty may be present. The smaller ones sometimes coalesce and form others of considerable size. Itching is never a prominent symptom, and in most cases it is absent altogether.

The usual duration of impetigo contagiosa is two or three weeks; it, however, runs no regular course, and by continued auto-inoculation may last much longer than this.

The disease is undoubtedly due to some form of local bacterial infection,

but the exact nature is not yet determi
but is usually seen in one who is cachectic

The diagnosis is not often difficult, an
tures—viz., the occurrence of several case
pustules situated upon the face and ha
prompt cure by local measures only. The
times confounded with pemphigus, and th
ential diagnosis may be quite difficult.

Treatment.—This is simple and usuall
to be softened and removed by thoroughly
water or a bichloride solution, after which
combined with three parts of vaseline, sho

URTICARIA

Urticaria is a frequent disease in early
particularly in infants and young children
those seen in adults. This is due to th
and occasionally pustules, are associated w
quickly subside, it frequently happens th
are the only ones present. This fact has
fusion in names, and the urticaria of i
urticatus, *urticaria papulosa*, *strophulus*,
agreed that the clinical picture, which is a
disease, and that this is urticaria.

The initial lesion is the wheal, but on a
bility of the skin in young children, the p
older patients, so that it may result in the
papule or a vesicle. In a few hours the w
papules or vesicles remain, and without a
a very obscure one. The papules and v
quency upon the hands and feet, particula
more severe form of the disease in poorly n
accompanied by a pustular eruption, and t
tion (ecthyma). The usual appearance o
small inflamed red papules whose tops are c
scratching. The eruption may be limited t
general. It is as a rule more severe in regi

There is usually severe itching, which le
in this way the disease affects the general h
caria of older children does not differ essen
adults.

The character of the eruption in urtic
strongly suggest scabies; and unless one has
the development of the lesions, a differential

as almost every lesion, except the wheal, may be identical in both diseases. Other cases may resemble varicella.

Urticaria in early life is most frequently the result of some disturbance in the digestive tract. Almost any sort of derangement may produce it, the exciting cause varying with the patient. Exceptionally, it may result from other forms of irritation, such as dentition or intestinal worms, and it has been ascribed to malarial poisoning.

Treatment.—The milder forms of urticaria usually respond quickly to treatment; but when it is severe and has existed for several weeks, it is one of the most troublesome and intractable skin diseases of childhood. The treatment is to be directed primarily toward the condition of the digestive organs. Children should be put upon a milk diet, and even milk may need to be partially peptonized. The bowels should be kept freely open by calomel, a nightly dose of castor oil, or a morning dose of magnesia. If the urine is excessively acid and scanty, alkaline diuretics should be given. The drugs most useful for the indigestion with which urticaria is associated are salicylate of soda and nitro-muriatic acid, each of which is to be given after meals.

All local causes of irritation, such as rough flannel underclothing, should be removed. The sleep may be so much disturbed as to require the use of trional or bromide and chloral. The two remedies which are of most value for the disease itself are antipyrine and atropine; they may be used separately or in combination, and should be administered in moderately large doses.

The local irritation and itching may be relieved by a lotion of menthol (gr. ij, water ℥ j), by a very dilute solution of the subacetate of lead or carbolic acid, or by a mixture of vinegar, or the fluid extract of hamamelis, and water. Where pustules are present, the white-precipitate ointment may be used, combined with four parts of vaseline; in the papular and vesicular forms, an ointment of ichthyol or naphthol, one per cent strength. In many cases the improvement in the general health by the use of tonics, change of air, etc., will accomplish more than any measures directed especially to the relief of the urticaria.

SCABIES.

Scabies is a contagious disease due to the burrowing into the skin of the female acarus, with secondary lesions which result from scratching. This disease is not a common one in New York, even among dispensary patients, while among the better classes it is extremely rare.

The burrowing of the acarus is usually where the skin is thinnest—viz., between the fingers, on the flexor surfaces of the wrists, the axillæ, and, in males, the genitals. It is not seen upon the face, except in infancy, when it may be infected by contact with the breasts of the mother.

The lesion excited by the acarus is usuall
a pustule. In some cases no evidences
in infants and young children they may
being frequent and often extensive, espe
The characteristic burrow is from one fo
and appears as a fine brown or black line
may be discovered as a small white speck.
to find in infants. They are generally to
of the hand and between the fingers. T
lesions varies greatly in different cases; i
in others, particularly in delicate, cachect
are sometimes very severe, so that the sk
covered with pustules. This is especial
pustular eruption should always suggest s
from scratching may be found on any acces
are usually at first linear, bloody marks,
be visible, and there may be only a traun
urticaria is often associated.

The diagnosis of scabies is usually q
family are likely to be affected, particula
The diagnostic features of the eruption ar
cles, or pustules, especially upon the hand
ful examination with a lens will usually
istic burrows, or even the acarus. In inf
founded with the vesicular form of urtic
the lesions has been observed.

Scabies may always be cured, provided
to prevent re-infection. This necessitates
patient's clothes, but all the bedding as w

Treatment.—This should always be b
soften the epithelial scales about the burr
oughly scrubbed with soap and water, p
bath being continued for at least half a
night. After the bath, the body is anoin
should be thoroughly rubbed into the s
the child put into a perfectly clean bed.
may be washed off, but none of the clot
put on. This treatment is to be repeat
nights, and if thoroughly done it will effec
ointment is too irritating for use in litt
lowing may be substituted: naphthol, 15
vaseline, 100 parts (Kaposi); or, precipit
Peru, 1 part; vaseline, 8 parts; or the sim
plied without dilution. After the use of t

required for a few days, some soothing application like those mentioned in the chapter upon Eczema.

TINEA TONSURANS—RING-WORM OF THE SCALP.

Ringworm of the scalp is a very frequent disease in institutions for children, often occurring as an epidemic. According to Crocker, the primary lesion consists in a red papule surrounding a hair, which soon increases to a small circular patch; this spreads at its outer margin, gradually increasing in size until it is from one to two inches in diameter, but rarely larger than this. Sometimes several of the patches coalesce. These affected areas always have rounded borders, and are sharply outlined. Here the hairs are very brittle, and often broken off close to the scalp, so that it may appear to be bald. Where they have not fallen off, the hairs have lost their lustre. The stumps of the broken hairs point in all directions.

The fungus which produces the disease is the *trichophyton tonsurans*. It penetrates the shaft of the hair, both the spores and the mycelium being seen under the microscope. The spores are present in great numbers in the hair, but the mycelium is most abundant in the scales. The amount of inflammation found in the diseased areas varies much in the different cases. There may be only a scaliness of the scalp, or a formation of pustules in the hair follicles, the hairs loosening and falling out in consequence. In young infants where the hair is scanty and thin, the disease resembles tinea circinata—i. e., it is superficial, and the hair follicles are often not involved. Children of all ages are liable to tinea tonsurans. It flourishes particularly in those who are dirty and poorly cared for.

The diagnostic feature of the disease is the presence of scaly patches, with loss of hair. The patches are usually circular, and by examination with a lens the stumps of broken hairs are seen all over the diseased area. By a microscopical examination the fungus is discovered. In typical cases the diagnosis is easy if the process is at all advanced, but there are many atypical forms and many mild cases where the recognition of the disease is difficult. The symptoms are often masked by the inflammatory conditions present. The disease may be confounded with seborrhœa; but in the latter the lesion is diffuse, never sharply defined; there is general thinning of hair over the scalp, and never the stumpy, broken hairs. Psoriasis has points of resemblance, but it is usually found on other parts of the body, especially the knees and elbows, and upon the scalp the patches are more numerous and smaller. In eczema the loss of hair in circumscribed patches is never seen, nor are the broken stumps.

Tinea tonsurans is always curable, provided the patient can be kept under close surveillance, and treatment thoroughly carried out. There is no tendency to spontaneous recovery. In a recent case, treatment must

usually be continued for one or two mo
six months to one year, with the closest

Treatment.—The great difficulty in tr
deeply enough into the scalp to reach the
very bottom of the hair follicles. As a
short all over the patch and for at least
sary in order to get at the diseased part a
early—if possible before the fungus has e
The parasiticide should be applied not o
and the entire scalp should be washed t
week. To prevent the disease spreading,
ened by the use of carbolic soap. The ha
tends to scatter the spores and spread
under treatment, should wear a cap of n
with paper, in order to prevent infecting
children should invariably be isolated.

To destroy the fungus almost every
advocated at one time or another, which
obstinate one, and that no one application
which have the sanction of the widest us
bichloride, white precipitate, and oleate
and croton oil. As a vehicle for ointmen
ferred to vaseline or lard; according to
parts of lanoline to one part of olive oi
alone. Most of the germicides mentioned
to five per cent, according to the age of
the scalp. In an epidemic of ring-worm i
the following combination of bichloride
satisfactory: ten grains of the bichloride
to this were added two and a half ounces
This was applied every day, being thoro
patches, and the whole scalp saturated w
usually resulted, and every few days the pa
simple emollient applied until the irritat
In some of the cases, the tincture of iodine
ride and kerosene. Twenty-six cases were
cured, the average duration of treatment b

Epilation is necessary in many cases as
of germicides, particularly in older childre

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* A full report of these cases was made by C
Medical Journal, October 10, 1891.

CHAPTER VI.

ACUTE OTITIS.

OTITIS is a frequent affection during infancy and early childhood, attacks usually occurring in the cold season. Of all the inflammatory conditions which may be met with in early life, there is perhaps none which more frequently gives rise to obscure febrile symptoms than this.

Etiology.—Acute otitis, as a rule, is a secondary disease, and is generally preceded by some infectious process in the rhino-pharynx. The usual avenue of infection is through the Eustachian tube. The catarrh of the pharynx may be a simple one, the ordinary head-cold, or it may occur as a complication of the acute infectious diseases. Downie gives the following statistics of 501 cases of tympanic involvement treated in the Children's Hospital in Glasgow:

Originated during measles	131	cases,	or	26·1	per cent.
" " scarlet fever	63	"	"	12·6	" "
" " whooping-cough	15	"	"	3·0	" "
" " mumps	3	"	"	0·6	" "
" " simple catarrh	147	"	"	29·4	" "
" " dentition	101	"	"	20·0	" "
Syphilitic	8	"	"	1·6	" "
Doubtful	33	"	"	6·7	" "
	501			100·0	

The most common condition preceding severe otitis is scarlet fever, and next in the order of their frequency, epidemic influenza, simple acute pharyngitis or tonsillitis, measles, diphtheria, and typhoid fever. Otitis when following simple inflammations of the throat is usually much less severe than when it complicates scarlet fever or diphtheria. Cold and exposure frequently play the rôle of exciting causes. In a few cases the disease is the result of traumatism, such as a blow or traction upon the external ear, or the entrance of fluids through the Eustachian tube from the nasal douche. It sometimes results as an extension of inflammation from meningitis, especially the cerebro-spinal form. When seen as a complication of scarlet fever, measles, or diphtheria, the symptoms are usually manifested from the sixth to the tenth day of the disease.

Lesions.—The ordinary course of events in the pathological process is, first, acute hyperæmia and swelling of the mucous membrane of the rhino-pharynx, which extends into the Eustachian tube, causing obstruction more or less complete. The inflammatory process may be limited to the tube, or it may extend to the mucous membrane lining the middle ear.

There are two varieties of acute inflammation of the middle ear: (1)

The catarrhal form, which usually acc
rhino-pharynx or complicates measles. T
cous membrane merely, and its products a
It is not usually accompanied by great pa
quences. It is generally confined to the
ity, and is the form most frequently seen i
form, which affects older children princi
rious inflammation, and is often excited b
fever, diphtheria, or epidemic influenza.
find their way into the middle ear in grea
mation of a more or less virulent type,
mucous membrane lining the tympanum
the upper part of the tympanic cavity.

The catarrhal form of inflammation f
with proper treatment, the only result b
temporary. The phlegmonous form ca
chian tube, rupture or sloughing of the
charge of the products of inflammation,
burrowing along the cartilages. The infla
the bones, causing necrosis of the ossicles
panum. The remote results are periosti
bone, pachymeningitis, infectious thrombo
purulent meningitis, and cerebral abscess.
Complications.

Symptoms.—These are usually few in n
bility as regards their combinations and
stant symptoms are pain and fever. In a
is generally at the beginning some dischar
tion of the pharynx and tonsils, and a t
There is nothing characteristic about thi
days the objective symptoms subside, but
less, worries much of the time, wakes fre
nurses poorly, and if the thermometer is us
ture remains elevated, usually from 99° to
cidedly ill, and yet no very definite symp
there is marked tenderness about the ear, a
the affected side, or shows signs of pain wh
week or ten days a discharge is found in
there follows a rapid subsidence of the cons
cases there is seen only a high temperature
which persists for several days without out
signs of inflammation, the discharge being
the physician to suspect disease of the e
marked dulness, apathy, anorexia, and sor

but for several days no evidence of pain; the temperature may be but little elevated. Thus, in most of the attacks seen in infancy, pain is not very marked, and it is this which so often leads to the great obscurity of the symptoms.

In older children the symptoms are more characteristic. Pain is usually sharp and severe, and is complained of early in the attack. The temperature is nearly always elevated two or three degrees, and occasionally it is 103° or 104° F., with severe headache, extreme restlessness, and even delirium or convulsions, so that meningitis may be suspected.

The inflammation does not necessarily go on to suppuration and rupture. There are even more frequently seen, accompanying ordinary head-colds or mild attacks of influenza, cases in which the pain is quite severe for twenty-four or thirty-six hours, and accompanied even by a moderate elevation of temperature, and yet which rapidly subside without further symptoms. In these cases the pain is too constant and too prolonged to be an attack of neuralgia. They are simply cases of a mild form of inflammation.

In infants suffering from malnutrition or marasmus, otitis not infrequently comes on without any objective symptoms, the first thing noticed being the discharge. This association of otitis with marasmus is to be attributed to the frequency of swelling of the adenoid tissue in the pharyngeal vault, upon which the catarrhal process depends.

Of the individual symptoms, fever is the most constant, and is present in all except the cases of marasmus just mentioned. The usual range of temperature is from 100° to 102° F.; exceptionally it may be from 103° to 105° F. The course of the temperature is irregular and remittent. After spontaneous rupture or incision of the drum membrane the temperature usually falls, but often not immediately; occasionally it continues almost as high as before for twenty-four hours. Pain is more marked in older children than in infants: first, because in the latter the drum membrane is not so firm, yields more readily, and ruptures earlier; and, secondly, because the inflammation is usually of the catarrhal and not the phlegmonous type. Tenderness is sometimes elicited by pressure just in front of the external auditory meatus; there may be increased sensitiveness of all parts of the ear and even of the whole side of the head. Children not infrequently complain of noises in the ear. One little girl with obscure symptoms and high temperature, first called attention to her ear by the remark, that she "heard pussy in the room." A sense of discomfort resembling that which is felt when the ears are stopped, frequently leads children to pick at them. Cerebral symptoms are infrequent, and occur chiefly in cases not receiving proper early treatment; they are practically limited to the phlegmonous form of inflammation, and they may indicate meningeal congestion, less frequently localized meningitis or thrombosis.

The local appearances in the early
tympanic membrane can be obtained—a
later there is distinct bulging of the mem
place, its site may or may not be visible,
existence may always be assumed, if ther
if bubbles of air are seen deep in the
occurs upon blowing the nose or inflati
mucus or pus is present, as inflammatio
never causes much discharge. A dischar
tion has taken place. The pus in rare
tilages and open externally behind or at t
of the discharge depends upon the variety
form it is at first sero-mucus, whitish in co
and usually continues when once establish
In the phlegmonous form it is always pu
and liable to a sudden arrest with an ex
symptoms. As the case improves the di
and gradually assumes a serous character.

Diagnosis.—In typical cases characteri
this is usually easy, particularly in older
frequently obscure, sometimes because the
attention to the seat of pain, but more oft
entirely absent. The temperature is alm
usual problem presented to the physician
fever. In the absence of definite otoscopi
presence of faucial congestion, a history of
lessness at night, and the absence of other
digestive tract, which might explain the
ness, or noises in the ears are of much signi
are very often wanting. Otitis is so comm
in infants during the cold season, that one
out for it. In older children a neuralgia a
give rise to a pain resembling that of otitis.

Prognosis.—The ordinary catarrhal for
followed by serious consequences, unless th
phlegmonous form, especially when it com
serious, and in the majority of cases it is f
pairment of the sense of hearing.

Complications and Sequelæ.[*]—Remote c
be seen in cases following scarlet fever, prob
particularly when early treatment has bee
the symptoms are obscure because the dis

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[*] See Pitt's Gulstonian Lect

slight or wanting. It is to be remembered in this connection that the Eustachian tube, middle ear, and antrum, in young children are relatively large, and hence easily infected, while the mastoid cells are imperfectly developed. These anatomical conditions explain the greater frequency of extension of the disease to the petrous bone and the brain, and, as compared with adults, the infrequency of mastoid complications.

Meningitis.—This may be a cause of death in young children. There may be a localized pachymeningitis with the formation of pus, or a general purulent meningitis. It may be secondary to other lesions, such as thrombosis of the lateral sinus, or the rupture of a cerebral abscess, but is usually due to the passage of pus through the roof of the tympanum, or along the internal auditory meatus. Meningitis is more frequent as a complication of old cases, but may develop soon after the early acute symptoms. Its onset is usually sudden, and its duration rarely more than a week.

Cerebral abscess.—This is due to a direct extension of the infectious process from the bone, vein, or dura mater. In about two thirds of the cases the abscess is in the temporo-sphenoidal lobe. The next most frequent seat is the lateral lobe of the cerebellum. Körner states that disease of the mastoid and middle ear leads to cerebral abscess, and disease of the labyrinth to cerebellar abscess. Abscesses may be complicated by thrombosis or by meningitis. They are often latent until just before death, which more frequently occurs from the development of purulent meningitis than from any other cause. They are rare except in cases of long standing.

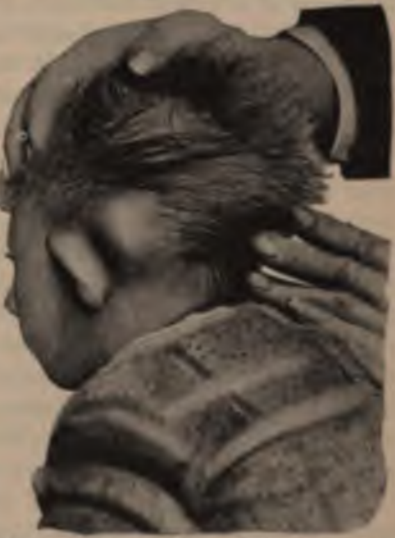

Fig. 152.—Mastoid abscess following acute otitis.

Thrombosis of the lateral sinus occurs as a condition antecedent to meningitis or abscess, or without them. It usually develops suddenly, with recurring chills and a high temperature, which is subject to sudden and wide fluctuations.

Mastoid disease, as previously stated, is not so frequent a complication of otitis in children as in adults, one reason being that the mastoid process contains but a single cavity, the antrum, whose walls are so thin that spontaneous rupture externally readily occurs, while the mastoid cells are very imperfectly developed until after puberty. Mastoid disease may accompany either acute or chronic otitis. There are local

pain and tenderness and a very characteri
ear to stand out from the head (Fig. 153
suppuration, with the symptoms of extern
times occurs. This may often be promot
cold either in the form of an ice bag or a

The labyrinth is less frequently involv
by Pye, Phillips, and others, in which the
entire labyrinth has occurred after scarlet
the deafness was complete, and in several

Facial paralysis rarely occurs in the
considerable proportion of the chronic one
the inflammatory process from the bone
passes through the canal. The symptoms
facial palsy.

Treatment.—If the case is seen in th
may not infrequently be cut short by loc
heat. Blood-letting is not to be advised i
may be used in children over two years o
of its obvious disadvantages, as nothing is
wet cups may be employed. They should
close to the tragus. Dry heat is to be pr
means of arresting inflammation and of reli
by means of a bag of hot water, salt, or b
stone. These should be placed beneath
child's head rests. If the child will not
bag of salt or hot water may be bound ov
covered by cotton. Perhaps the best of all
tip of the finger of a kid glove with salt, a
after heating; cotton should be applied o
used for a short time, being changed fre
tinuous poulticing encourages suppuratio
On no account should oil, or oil and laud
as is so often done in domestic practice.
in the course of a couple of hours after t
opiate should be given. This not only reli
able influence upon the inflammation.

A return of the severe pain on the follo
spite of ordinary measures, with a steadily
tions for operative interference. If to the
added, operation is imperative. An early i
is usually followed by a discharge of blood
and with it the pain disappears, and the i
sides without the formation of pus. Mu
and, as the wound heals quickly, much less

ing the disease to go on to a spontaneous rupture. Later operation may be required either for the relief of pain or the evacuation of pus, in order, if possible, to prevent the disease from spreading to the bony parts.

After incision or spontaneous rupture of the drum membrane, the pain usually ceases, although the temperature may not fall to normal for twenty-four or thirty-six hours, even with good drainage. The discharge is now the principal object of treatment. Nothing else is necessary than to keep the ear perfectly clean. The canal should not be plugged with cotton, nor should it be stopped by the insufflation of powders. It should be syringed with a solution of bichloride (1 to 5,000), or a saturated solution of boric acid, or simply with boiled water. All these fluids should be used warm, and, if the discharge is purulent and abundant, as often as every two or three hours—in all cases several times a day. A bulb ear-syringe of soft rubber is the most satisfactory instrument for general use. It is a mistake to keep the ears covered by a thick mass of cotton or flannel, as is so often done. In the house no protection is necessary. A sudden rise in the temperature usually means that drainage is imperfect; if it is accompanied by pain, a second incision may be necessary. If the temperature remains high, one should be on the lookout for mastoid disease.

In most cases the discharge ceases in from one to three weeks; should it continue longer, some measures for checking it may be used. Dench advises as better than other applications, the use of a few drops of a saturated solution of boric acid in alcohol after syringing. It should be applied with a medicine dropper. Where the discharge has become fetid, syringing once a day with a solution of peroxide of hydrogen (1 to 4, or even stronger) is often useful. A persistent discharge often depends upon the fact that the child's general condition is poor, and improvement in this will do more to stop the discharge than any variation in local treatment.

One attack of otitis is frequently the precursor of many others. Children sometimes have one or more attacks every winter for several years. Such children are usually those who are very prone to catarrhal colds, and in most of them will be found adenoid vegetations in the pharynx. In order to get rid of this tendency to attacks of otitis, such growths should be removed and all other associated pathological conditions treated. The nose should be kept as clean as possible by frequent use of the hand atomizer with some mild cleansing solution, such as Dobell's or Seiler's. The rhino-pharynx may be touched once in two or three days with a solution of nitrate of silver (10 to 30 grains to the ounce).

Cold sponging about the neck and chest should be employed, as well as every means to reduce the susceptibility to acute catarrh. The remote dangers from these recurring attacks are often overlooked. They may be the beginning of a chronic condition, the full effects of which are not

seen until adult life is reached, both
often thinking that all danger has passed
subsided.

The treatment of chronic otitis and
largely surgical, and belongs to the speci
tant that the general practitioner shoul
toms, and realize the danger from these
function of hearing, but also to life itse
ment is to operate sufficiently to secure fr
ough cleansing of the parts. Too mu
expectant treatment of these cases, or a
poulticing.

SECTION IX.

THE SPECIFIC INFECTIOUS DISEASES.

Accurate classification of the infectious diseases is at the present time impossible, but there are two quite distinct groups into which, with one or two exceptions, those here considered may be placed.

The first group includes scarlet fever, measles, rubella, varicella, and pertussis. The nature of the specific poison in each of these is as yet unknown. They are, strictly speaking, contagious; for it is practically certain that any of them may be contracted by proximity to a person suffering from the disease, without actual contact. In no one of these diseases is the poison given off in a single definite discharge, and in no one is there a characteristic visceral lesion. Mumps resembles the members of this group in all points except the one last mentioned. These peculiarities, together with the fact that thus far the poison of each of these diseases has resisted all attempts at isolation, render it not improbable that these poisons are some other variety of micro-organisms than bacteria.

In the second group may be placed diphtheria, typhoid fever, and tuberculosis, in each of which the specific poison is a known form of bacteria. Each of these diseases is associated with definite and characteristic visceral lesions. The poison is discharged from the body in a certain well-understood manner from the tissues which are affected by the disease, and in no other way. These diseases can not be contracted by proximity to a diseased person, but only by receiving into the body the specific germs, either by contact with a person suffering from the disease or contact with something upon which the special germs of the disease have been discharged. In other words, though communicable, they are not, strictly speaking, contagious.

Syphilis, influenza, and malaria have not been included in either of the above groups. Syphilis must still be placed in the doubtful class, although its general characteristics ally it with the second group. The fact that a certain germ—Lustgarten's bacillus—is quite uniformly found in syphilitic lesions also points in the same direction; the evidence, however, is not conclusive that this bacillus is the cause of the disease. In its communicability, influenza resembles the first group, although there is now little doubt that it is due to a form of bacteria—Pfeiffer's bacillus.

Malaria belongs in a class by itself, differing in nearly all its essential features from the other diseases of this general group, as its specific poison is known to be a form of protozoa.

CHAPTER I.

SCARLET FEVER.

Synonym: Scarlatina.

SCARLET FEVER is an acute, contagious, self-limited disease, one attack usually protecting the individual through life. The period of incubation is usually from two to six days; that of invasion, from twelve to twenty-four hours; that of eruption, from four to six days; that of desquamation, from three to six weeks. The disease may be communicated at any time from the first symptom of invasion throughout desquamation, and sometimes even during the existence of purulent discharges from the nose or other mucous membranes. It is usually ushered in by vomiting, high fever, and sore throat, and is characterized by an erythematous rash appearing first upon the neck and spreading rapidly over the entire body. Its chief complications are otitis and membranous inflammations of the pharynx, which frequently extend to the nose, more rarely to the larynx. The most important sequelæ are deafness and nephritis.

Etiology.—Analogy leads to the belief that scarlet fever is due to a micro-organism, but as yet its nature has not been discovered. The complications are usually associated with the growth of the streptococcus pyogenes. Some have gone so far as to claim that this germ is the cause of the disease. From present knowledge, however, it appears rather to play the rôle of a secondary or accompanying infection, for the development of which the mucous membranes of a person suffering from scarlet fever seem to afford most favourable conditions. To the streptococcus may be ascribed the membranous inflammations of the tonsils and pharynx, the otitis, the inflammation of the lymph nodes and the cellular tissue of the neck, and probably also the nephritis, pneumonia, and joint lesions. In many of the above conditions, the streptococcus is associated with other pyogenic germs, and in some cases with the diphtheria bacillus.

Predisposition.—The susceptibility of children to the scarlatinal poison is much less than to that of measles; still, it is much greater than that of adults. Billington (New York) records observations made in twenty-six families living in tenements where little or no attempt at isolation was made. In these families there occurred 43 cases of scarlet fever; but 47 other children, although unprotected by previous attacks and constantly exposed, did not contract the disease.

Johannessen reports that of 185 children under fifteen years who were exposed, 28 per cent contracted the disease; while of 314 adults, only 5 per cent contracted the disease. It may be stated that, approximately, not more than one half of the children exposed take the disease. The susceptibility is not great in early infancy, but it increases until about the fifth year, after which it steadily diminishes. Both sexes are equally liable to scarlet fever. Epidemics are more frequent in the fall and winter than in summer, and cases occurring in the cold months are apt to be more severe. Whitelegge, in 6,000 cases, found the highest mortality in the month of October; and in Caiger's report of 1,008 cases this was also the month showing the greatest mortality.

Incubation.—Of 113 cases[*] in which the period of incubation could be accurately determined, it was as follows:

24 hours or less	6 cases.
2 days	15 "
3 "	28 "
4 "	25 "
5 "	6 "
6 "	15 "
7 "	8 "
8 days	2 cases.
9 "	5 "
11 "	1 case.
14 "	1 "
21 "	1 "
	113 cases.

Thus in 87 per cent of these it was between two and six days, and in 66 per cent between two and four days. The incubation is rarely over a week; it is particularly short in surgical cases, a well-authenticated instance being on record in which it was but six hours. Speaking generally, if, after exposure, a week passes without symptoms, the chances of infection are very small. A short incubation is more frequently seen in severe than in mild cases.

Mode of infection.—The chief source of infection is the patient himself. It is somewhat doubtful whether the poison of scarlet fever can be conveyed by the breath, but it may be by discharges from the mucous membranes involved, from the scales during desquamation, and probably from all the excretions,—urine, fæces, and perspiration of the patient. Infection often takes place from the carpets or furniture of the sick-room, and from the clothing of the patient. In a city the bed-clothing, while airing in the window, has been known to convey the disease to an adjoining house. Instances are recorded of the spread of scarlet fever by the washing of infected with other clothing. Toys or books may be carriers of the disease. A bouquet of flowers sent from a sick-room to an institution, in one instance proved a vehicle of infection. Cats, dogs, and other domestic animals are known to have conveyed the disease. Scarlet fever is sometimes spread by food, particularly by milk, as in the well-known epidemics of Hendon and Wimbledon (England). It is possible, under these circumstances, that a disease resembling scarlatina existed in the cows; but that this was identical with scarlatina, as seen in man, was not demonstrated.

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[*] Part of these are from personal observation, but the great majority are isolated cases scattered through medical literature, occurring under circumstances which made it possible to determine the exact length of incubation.

The transmission of the disease through a third party is not frequent, but numerous instances of it are on record. The persons most likely to carry it are the nurse and the physician. Physicians have in many cases carried scarlatina to their own children, but only when there had been pretty direct contact with the patient, and where the interval before seeing the second child was short. The clothing of the nurse may be almost as infectious as that of the patient. The transmission of the disease by one who, although living in the house, does not come in contact with the patient is extremely improbable. I can find no instance recorded where scarlatina has been transmitted through two healthy persons.

Duration of the infective period.—There is no evidence to show that the disease is communicable during the period of incubation. It, however, becomes so from the beginning of invasion, even before the rash appears. Infection is doubtless most active during the febrile period—from the second to the fifth day—and, next to this, during the stage of active desquamation.

In simple cases, the average duration of the contagious period may be placed at six weeks, or until desquamation is complete. However, physicians generally have been accustomed to place too much stress upon the danger from the scales, and too little upon that from the discharges from the mucous membranes. Early infection comes chiefly from the throat, nose, or possibly the breath. Late infection may arise from a purulent otitis, rhinitis, chronic pharyngitis, suppurating glands, eczema, empyema, and possibly also from the urine in nephritis. The infectious nature of these purulent discharges has not been sufficiently recognised. It is possible for them to convey the disease during a period of several months. One case is recorded in which scarlatina was communicated through a purulent nasal discharge after eleven weeks; another in which the opening of a post-scarlatinal empyema in a surgical ward was followed by an outbreak of scarlet fever.

In winter especially, a chronic pharyngeal catarrh may long contain the germs of infection. Ashby found, on careful investigation, that from two to four per cent of patients discharged from a scarlet-fever hospital subsequently conveyed the disease. There is particular danger from a child who has recently had the disease sleeping with other children. Line records a case in which this was the means of conveying the disease after fourteen weeks, and when the patient had been considered perfectly well for three weeks. It is impossible to say that at any specified time absolute safety exists. All patients before being discharged from a hospital or released from quarantine in private practice, should be carefully examined as to the condition of the mucous membranes, and quarantine continued as long as catarrhal inflammations are present. The poison of scarlatina clings more tenaciously to clothing, upholstery, and apartments than that of any other contagious disease, possibly excepting tuberculosis. Authentic cases are on record in which more than a year had elapsed between the first and second cases, where the source of infection seemed certain.

Lesions.—The only essential lesions of scarlet fever are those of the skin and the mucous membrane of the throat. The other changes occurring in this disease are considered in the light of Complications, under which head they are described.

The earliest changes in the skin consist in an intense hyperæmia with dilatation of all the small blood-vessels; following this, there is an exudation of round cells into the rete Malpighii, and considerable swelling, due partly to the exudation of cells and partly to œdema. There are also thickening of the lining membrane of the sweat ducts, and infiltration about these ducts with round cells. In some cases there is destruction of the epithelium lining the sweat ducts, and the lumen of the duct is filled with granular detritus, occasionally with blood. The local process results in death of the epidermis, which is cast off during desquamation. It is essentially an acute dermatitis, which varies in intensity with the severity of the attack. The only constant lesion in the throat is an erythematous pharyngitis, with the usual changes of a catarrhal inflammation.

Symptoms.—*Invasion.*—As a rule, the invasion of scarlet fever is abrupt, the symptoms at the onset usually being directly in proportion to the severity of the attack. In the majority of cases there are vomiting, a rapid rise in temperature, and soreness of the throat. Often the vomiting is repeated; it is frequently forcible, and without nausea. In severe cases the rise in temperature is very rapid, to 104° or 105° F.; in the mildest cases it may not be above 101°. A child may complain of soreness of throat, or the throat symptoms may be entirely objective. In most severe cases, there is a uniform erythematous blush covering the pharynx, tonsils, and fauces, but on the hard palate consisting of minute red points. The appearance of this is usually coincident with the rise in temperature. Occasionally membranous patches may be seen upon the tonsils the first day, but not generally before the third or fourth day In mild cases the throat shows only a very moderate congestion, and in some presents nothing abnormal. Severe cases are sometimes ushered in by convulsions, especially in very young children. Diarrhœa is not uncommon in summer. There is general prostration, which is directly proportionate to the height of the fever.

Eruption.—This usually appears from twelve to thirty-six hours after the first symptoms of invasion; exceptionally, not until the third or even the fifth day. A later appearance than this is somewhat doubtful, for the rash not infrequently recedes and reappears, having been overlooked in

the first instance. In 108 cases observed
the duration of the rash was as follows:

Two days or less ....
Three to seven days ....
Eight to eleven days ....
Over eleven days.......................
Recurring...............................

These statistics are confirmed by the
the rash lasts from three to seven days.
is generally seen in from twelve to twent
ance, and not infrequently the whole
four or five hours. Very rarely its exte
three days before the body is covered.
variably upon the neck and chest. Wh
times earliest and most intense over th
the thighs. In the cases of moderate sev
is of a bright scarlet colour, and on clos
up of very minute points; it covers the
There is often a peculiar pallor about the
the rest of the face, which is quite charac

Variations in the eruption are very fre
zling. In the mild cases the rash is not
faint upon the body, and may be present
last only one day, and sometimes may
altogether. It may be absent in some ve
where the throat symptoms are severe, a
very severe cases many irregularities are
appearance of the eruption and its char
large, irregular patches; at others it is
rash of measles; occasionally it is of a
rarely it is hæmorrhagic. An eruption o
observed in connection with a fully-develo
attached by the laity to the early disappe
danger being believed to exist because th
well-developed bright scarlet rash indicat
sudden recession of the rash is a sign of he
is faint and doubtful in character, may be

With the eruption at its height, there is
the skin, and in severe cases considerable s
the hands and face. All the constitutional
as the rash develops, and usually diminish

Desquamation.—Shortly after the rash
tion of the dead epidermis, known as des
characteristic of the disease than the rash.

the neck and chest, where it appears as fine scales or small patches. The desquamation of the trunk is completed in from one to three weeks. If baths and inunctions are being used, it is scarcely perceptible. It continues longest where the epidermis is thickest—viz., upon the hands and feet—and here it lasts from three to six weeks, and not infrequently eight weeks. The appearance of the fingers and toes during desquamation is characteristic. The finger tips usually peel first, and the new epidermis is pink and fresh-looking, while that which has not yet separated is of dull gray colour and loosened at the margin. Occasionally the epidermis of a considerable part of a finger may be loosened at once, so that a partial cast may be thrown off like the finger of a glove. Sometimes the patient comes under observation for the first time during desquamation, the history of the early symptoms being doubtful or absent. Such desquamation as has been described, occurring both upon the hands and feet, may be regarded as conclusive evidence of scarlet fever, no matter what the history may be.

1. *The mild cases.*—The symptoms may be so slight as to be entirely overlooked, nothing being noticed until desquamation occurs. Usually, however, there is a rather abrupt invasion, with vomiting and a temperature of 100° to 103° F. The tonsils and pharynx are congested, while the palate shows a punctate redness somewhat like the cutaneous eruption. Nearly always within twenty-four hours the rash makes its appearance, generally first upon the neck and chest. Very often it is not seen upon the face, but the rest of the body is usually covered. The rash fades on the third or fourth day, and has disappeared by the fifth day. There is very little prostration, the child often being with difficulty kept in bed.

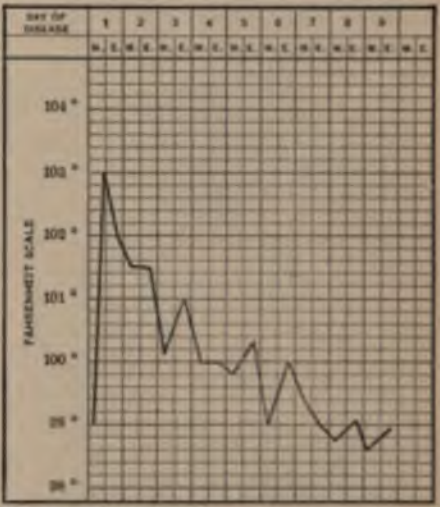

FIG. 154.—Typical temperature curve of mild scarlet fever; uncomplicated; in a child three years old.

The highest temperature is coincident with the full eruption, and is seen during the first thirty-six hours of the disease. It gradually falls to normal by the fourth or fifth day. Its typical course is shown in Fig. 154. In the mildest cases the temperature may never be above 100° F., and the rash may last but one day, and even then may come out very imperfectly and over only a portion of the body—the chest or the loins.

Desquamation is often faint over the body, but is unmistakable over

the hands and feet. It begins about th
being most marked where the eruption h

The mild cases are usually uncomplic
and of late nephritis should always be ke
even with the mildest attacks. The diffi
tacks of scarlet fever are often great. It
cases are just as contagious as severe ones,
severe one is often contracted. It is freq
this disease is spread in schools. In dis
tients desquamating from scarlet fever,
regularly up to the time when they were
phritis or some other disease.

2. *Cases of moderate severity.*—The
which is usually repeated, or with conv

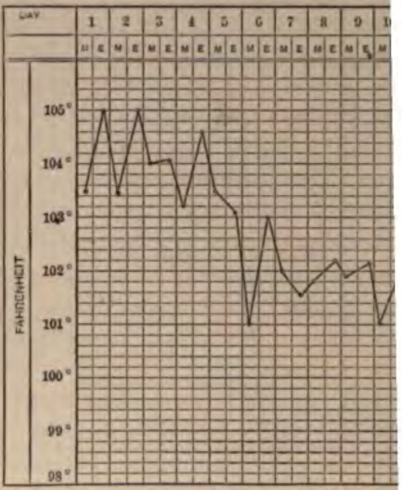

FIG. 155.—Moderately severe scarlet fever, running a
tions; the patient, a boy two an

rapidly, and by the end of the first twenty-
105° F. The rash usually appears within
its intensity is directly proportionate to th
pearing first upon the neck or chest, it exte
trunk, extremities, and often the face in a
in appearance, being made up of minute po
of a uniform blush, which has been comp
change takes place in the rash for four or
quite rapidly, and disappears by the sevent

The throat resembles that of the mild
more intense and there is slight swelling of

and often pain upon swallowing. Occasionally small yellowish patches are seen upon the tonsils by the second or third day, but these can be wiped off and are not distinctly membranous. There is usually a moderate discharge of a sero-purulent character from the nose. The lymphatic glands at the angle of the jaw are swollen and quite tender. The tongue shows first a white, frosty coating, and after a few days may clear at the border. The intense redness at the tip and margin of the tongue, with the enlarged papillæ, gives rise to what is known as the "strawberry tongue," which, though not peculiar to scarlet fever, is a very frequent symptom.

During the height of the fever there are restlessness, thirst, and not infrequently slight delirium. The temperature reaches the maximum by the second or third day, and usually falls gradually after the fourth or fifth day, but even in uncomplicated cases the fever often lasts from ten to fourteen days (Fig. 155). The pulse in the early part of the disease is rapid and full, but later it may be weak. There is much prostration, frequently followed by quite a marked degree of anæmia.

This form of the disease rarely proves fatal apart from complications, but it may do so in very young infants. The complications seen most frequently in this form of scarlet fever are broncho-pneumonia or pleuro-pneumonia and otitis, the latter being usually double and occurring between the sixth and the fourteenth days. Nephritis is the only common sequel.

3. *The severe cases.*—The severe type of scarlet fever usually declares itself from the beginning. The incubation is short, and the full rash may be seen within a few hours after the initial symptoms. It covers the entire body, including the face. The severity of the infection is shown by the fact that the temperature is higher and continues for a longer period, and by the frequency and severity of the complications, particularly those of the throat. For the first two days the throat presents nothing different from what is seen in the milder cases. By the third or fourth day, however, membranous patches often appear on the tonsils, and spread to the soft palate, uvula, and pharynx, sometimes to the nose and through the Eustachian tube to the ear, rarely to the larynx. The mucous membrane of the mouth is intensely congested, and often partly covered by membrane; there is sordes on the lips and teeth, and there may be superficial ulcers, which bleed readily. The glands of the neck swell rapidly, often to a great size, and the cellular tissue about them is infiltrated. The head is thrown back to relieve the dyspnœa which the pressure from this swelling occasions. There is an abundant discharge from the nose and mouth; the breath is offensive, often fetid. The general symptoms are those of a severe septicæmia. The temperature is steadily high, usually between 103° and 105° F., the fluctuations being usually narrow for the first week or ten days. In cases which recover, the subsequent course is

greatly modified by the presence of com
generally lasts from three to four weeks.
may be steadily high till death (Fig. 15
pulse is rapid, weak, and irregular. T
food and stimulants have to be coaxed
delirium or apathy, and sometimes all t
dition are present.

Signs of a broncho-pneumonia are oft
end of the first week or early in the sec
The urine is rarely free from albumin, b
ally great; there may be hyaline and epit
some cases the throat symptoms predomi
sepsis, but more frequently the two are c
tionate to each other. In still other case
flammation, it may be of a gangrenous c
may take place in the throat, and even in

The duration of the symptoms in f
days. There are generally increasing
stupor, with death from exhaustion, fro
some of the complications,—broncho-pne
orrhages following sloughing, laryngitis,
cases which recover, the acute symptoms

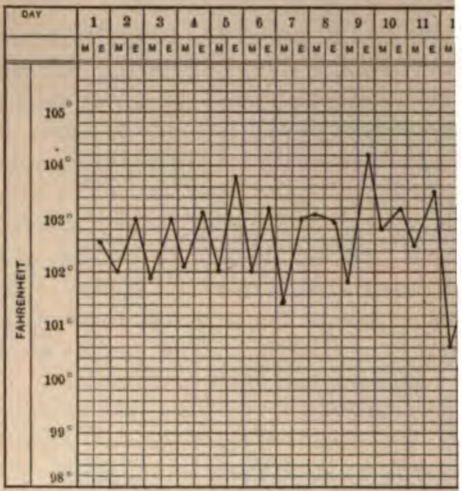

Fig. 156.—Severe scarlet fever complicated by doubl
longed; otitis began on the thirteenth day; neph
patient a girl twenty months old.

month; and after escaping the dangers o
tions, the child has still to run the gantle
nephritis, pneumonia, endocarditis, pyæm

as late as the end of the seventh week; nearly all such results are due to nephritis or to its complications.

4. *Malignant or cerebral cases.*—These are rare cases which are more frequently described than seen, and in which death takes place usually within the first forty-eight hours. The system is overpowered by the scarlatinal poison. Such cases are seen only in severe epidemics. Under other circumstances, many cases of unexpected death with high temperature are diagnosticated malignant scarlet fever which have no connection with this disease.

The onset is sudden and violent, usually with convulsions, the child passing in a few hours into a condition of deep stupor, with great prostration and hyperpyrexia, the temperature ranging from 105° to 107° F. The rash appears irregularly, late, or not at all. There are frequently repeated convulsions, cyanosis, and invariably a fatal termination. The autopsy often gives no satisfactory explanation of these cases. Death occurs from toxæmia, without any characteristic local evidences of disease.

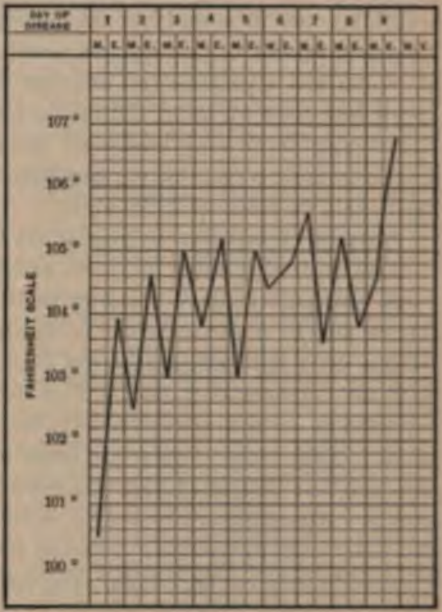

FIG. 157.—Severe scarlet fever, septic type; double otitis, severe membranous angina; death on the ninth day; the patient a girl seven years old.

5. *Surgical scarlet fever.*—Patients with recent wounds, or those who have been subjected to surgical operations, are peculiarly susceptible to the scarlatinal poison, and are almost certain to contract the disease upon exposure, unless protected by a previous attack. Whether the infection takes place directly through the wound, or whether the susceptibility depends upon the diminished resistance of the patient, is still an open question. This disease doubtless explains some of the unexpected deaths occurring after minor surgical operations. Scarlet fever may occur after any operation, even one so trivial as tenotomy or circumcision. Patients with burns are generally believed to be especially susceptible. The effect of scarlet fever upon the wound, and some of its peculiar clinical features, are illustrated by the following cases from Walton Browne (Belfast):

A healthy child was operated upon for hare-lip; sixteen hours afterward it became seriously ill, the skin was covered with a dark scarlatinal rash, and death quickly followed. Another patient who, it was afterward

learned, had been recently exposed direc
for congenital phimosis. In thirty hou
tinal rash and had a temperature of 10
became gangrenous and the patient pas
which he died in seventy hours. A chil
lacerated wound of the leg was accident
in which was a patient who had just dev
lasted less than an hour, but in six hour
iting, high fever and headache, became
fifteen hours, no rash having appeared.
rash could be seen upon the skin.

Surgical scarlatina is nearly always
incubation is very short, the rash usually
toms, particularly those relating to the
There may or may not be throat sympto
writers deny that surgical scarlet fever is
with an erythematous rash. This is un
reported as surgical scarlet fever; but it
of all. That some of these are cases of
the fact that they have been known to co
they are often followed by nephritis and u
the latter is not invariable. But in the a
quamation, and contagion, the diagnosis o
extreme caution. Care should be taken to
due to the various antiseptics used in surg

Relapses, Recurrences, and Second Att
scarlatina gives immunity through life.
some of them are well authenticated.
two attacks within eight months in a boy
gow) reports the case of a patient who
hospital within two years; such cases are

Relapses or recurrences within a brief
more frequent. There are to be excluded
which the rash, having temporarily subsid
pears; also those where the rash varies in
and, lastly, the cases in which, occurring
septicæmia or pyæmia. True relapses ar
sometimes to a new accession of poison
gous to the relapses of typhoid fever. The
desquamation, between the seventh and t
be not only a new eruption but a rise o
vomiting, just as in the initial attack. T
shorter and milder than the first attack, bu
since Körner mentions eight cases where t

In considering the subject of second attacks, the liability to errors in diagnosis must be borne in mind and only cases included which have presented typical symptoms.

Complications and Sequelæ.—*Throat.*—Three distinct forms of angina are seen in scarlatina: simple or erythematous, membranous, and gangrenous.

1. Erythematous angina.—This can hardly be ranked as a complication, as it is nearly as constant as the scarlatinal rash. Usually there is only the general blush over the entire pharynx with the fine red points upon the hard palate; but there may be seen upon the tonsils grayish-yellow spots resembling those of follicular tonsillitis, which can be wiped off, leaving a clean surface. This simple angina is at its height with the maximum temperature, and fades as the temperature falls. It does not often extend to adjacent mucous membranes.

2. Membranous angina.—These cases were formerly classed as scarlatinal diphtheria, and whether this process was identical with primary diphtheria or not, was for a long time a subject of much discussion. This question has, however, been settled by bacteriology. It is now generally agreed that the membranous angina which occurs early in scarlet fever, and that which develops at the height of the disease, are almost invariably due to the streptococcus, the diphtheria bacillus being rarely found; but that the cases which develop late in the disease, and after the primary fever has subsided, are almost invariably true diphtheria, the bacillus being regularly present. The latter condition is to be regarded as scarlet fever complicated by diphtheria.

The lesions of this form of angina are considered in the chapter on Pseudo-Diphtheria. Usually on the second or third day of the disease the membrane appears upon the tonsils, and in the milder cases it covers only the tonsils. In the most severe form it may be seen within twenty-four hours of the onset, frequently before the eruption appears. Beginning upon the tonsils, the membrane rapidly spreads to the entire pharynx, the mucous membrane of the nose, the mouth, the Eustachian tube, and even the middle ear. In colour it may be gray, greenish, or almost black. There is so much swelling of the throat that swallowing becomes difficult. The infiltration of the cellular tissue of the neck and the enlarged lymphatic glands produce great external swelling, which may extend like a collar from ear to ear. The breath has a foul odour, the nasal discharge is thin and fetid, and nasal respiration is obstructed, so that the mouth is open constantly. Occasionally the larynx is invaded, with the usual symptoms of membranous croup.

These local changes are accompanied by constitutional symptoms of great severity, which are due to a general streptococcus septicæmia; broncho-pneumonia and nephritis are very frequent, otitis is almost constant, and suppuration of the lymphatic glands is not uncommon.

As the eruption in these cases is late pearance, the diagnosis from true diphtl difficulty, and a positive diagnosis is pc from the throat.

3. Gangrenous angina.—This is seen c fever. The process may be gangrenous f membranous inflammation. It is sometin There is a fetid odour to the breath, irri and mouth, with very great glandular sw grayish-black in colour, and large masse moved with the forceps from the tonsils sometimes sloughing occurs in the cellu vessels of considerable size are often ope hæmorrhage may result. Little or no te seen. The constitutional symptoms are th and profound cachexia, followed almost in

Lymph nodes.—These are swollen in angina. The inflammation may be simply go on to suppuration. Abscess does not disease, but may come at any time during fined to the glands or be complicated by s of the neck. Disease of these glands is collis.

Cellulitis of the neck.—This usually oc week, and is associated with grave throat s infiltration occurs, the skin becomes tense back, and there may be considerable dysp only in the neighbourhood of the lymph Unless relieved by early incision, the diffuse and extensive sloughing, which may be dee vessels of the neck. This is a complicatio port. Death may occur from septicæmia from hæmorrhage due to opening by ulcera some of its branches; or there may be asso lar vein, leading to thrombosis of the latera

Ears.—The otitis is due to direct exten rhino-pharynx. It is the most frequent co doubtful cases may have some diagnostic younger the child the greater the liability in winter than at other seasons. Like all with the epidemic, and is closely connected symptoms. In an epidemic occurring in in the spring and summer of 1889 there w not one of otitis. In a fall and winter epi two years later, of 43 cases 20 per cent had otitis. Of 4,397 cases reported by Finlayson, otitis occurred in 10 per cent, and of 1,008 cases reported by Caiger, in 13 per cent. In Burkhardt's statistics the proportion was as high as 33 per cent. Of cases accompanied by severe throat symptoms otitis is present in fully 75 per cent.

As a rule, both ears are affected, but not simultaneously, or at least rupture occurs at different times. This is most frequent early in the second week, but may occur during convalescence. In the cases where otitis develops at the height of the disease there are in some cases no new symptoms; in others there are pain and deafness. If it develops at a later period there is usually a rise in the temperature, which falls after rupture of the drum membrane takes place. The otitis is sometimes overlooked until symptoms of pyæmia or meningitis develop. The form of inflammation may be catarrhal or suppurative (page 880), the latter being often accompanied by necrotic changes.

Bezold makes the following report upon 185 cases showing the results of scarlatinal otitis: "In 30 there was entire destruction of the membrana tympani, with loss of one or more bones; in 59 the perforation comprised two thirds or more of the membrane; in 13 there were smaller perforations; in 44 there were granulations or polypi; in 15 there was total loss of hearing on one side, and in 6 of the cases upon both sides; in 77 of the cases the hearing distance for low voice was less than twenty inches."

As a cause of permanent deafness and deaf-mutism, no disease of childhood compares in importance with scarlet fever. May (New York) has collected statistics of 5,613 deaf-mutes, of whom 572 owed their condition to otitis following scarlet fever.

Kidneys.—Albuminuria accompanies nearly all the severe cases of scarlet fever. In many this is simply the ordinary febrile albuminuria due to acute degeneration of the kidneys (page 612). In those with severe throat complications, and in nearly all the septic cases, there is an acute inflammation of the kidney, usually of the variety described as acute exudative nephritis (page 613). This occurs at the height of the febrile process and is rarely accompanied by dropsy; but albumin, casts, and even blood may be found in the urine. The most severe and the most characteristic renal complication, and that generally designated as *post-scarlatinal nephritis*, is a diffuse nephritis which in most cases develops during the third week of the disease. It is accompanied by general dropsy; the urine is scanty and not infrequently suppressed, and it contains a large amount of albumin and great numbers of casts of all varieties. It may cause death by the occurrence of acute uræmia, or it may be followed by permanent damage to the kidneys. It is more fully described with the Diseases of the Kidney (page 615).

Joints.—Acute articular rheumatism may occur coincidently with the development of the scarlatinal rash, and occasionally during convalescence in patients who have a predisposition to that disease. Acute swelling of the joints is sometimes of pyæmic origin. A case is reported by Henoch in which this was due to an infectious thrombus in the jugular vein, associated with cellulitis of the neck. In pyæmic arthritis the large joints are usually involved and the lesions are apt to be multiple. Joint disease may occur as a sequel of scarlet fever, where it is secondary to disease of the bone or to periarticular abscesses opening into the joint.

The foregoing include but a small proportion of the joint complications seen in scarlet fever. The most frequent and most characteristic form of inflammation is *scarlatinal synovitis*, or, as it is sometimes called, *scarlatinal rheumatism*. It occurs in different epidemics with varying frequency. Carslaw (Glasgow) in 533 cases of scarlet fever met with synovitis in 60 patients. It is seldom seen in children under three years of age, and is most frequent after five years. It may occur in mild as well as in severe cases. According to Ashby, it is more frequent when the febrile stage is prolonged, owing to other complications. Synovitis develops quite uniformly toward the end of the first or the beginning of the second week. The symptoms are generally mild, and are followed by prompt recovery. Suppuration is rare. Any of the joints may be attacked, but those of the wrist and hand are most frequently and often the only ones affected. Demme (Berne) has reported a case in which every large joint in the body was involved. The symptoms are redness, moderate pain, swelling, which is usually due to synovial distention, and sometimes a slight rise of temperature. The duration is generally but three or four days, and in most cases there is spontaneous recovery. This disease is distinguished from rheumatism by several points: it is not more frequent in rheumatic patients; cardiac complications are rare as compared with those seen in patients with genuine rheumatism; in some epidemics it is very common, and in others seldom seen; there is little or no tendency to relapses; anti-rheumatic remedies are without striking benefit; it does not skip about from joint to joint, and usually fewer joints are involved.

Lungs.—The pulmonary complications of scarlet fever are neither so frequent nor so important as those of measles. Broncho-pneumonia is usually found at autopsy in septic cases where death has occurred later than the third or fourth day, but it is not generally recognisable by physical signs.

In septic cases pleuro-pneumonia sometimes occurs early in the disease and at other times late, generally associated with nephritis, but occasionally without it. It is always a serious condition and not infrequently a direct cause of death. Empyema may follow pleuro-pneumonia or occur with pyæmia or nephritis, but with the latter, simple serous pleurisy is more common. Œdema of the lungs occurs chiefly with nephritis, in which it is the most common cause of death.

Heart.—Abnormal cardiac sounds, not dependent upon organic lesions, are frequent during the height of the disease. Endocarditis and pericarditis are not common. They are occasionally seen in septic cases and in those complicated by pyæmia, but principally as a complication of post-scarlatinal nephritis or in rheumatic patients. Endocarditis may be simple or malignant, and may be the cause of embolism and hemiplegia during convalescence.

A certain degree of degenerative change in the cardiac muscle is found in nearly every fatal case that has lasted over four days. More marked evidence of toxic myocarditis is not infrequent in the prolonged cases and in those of a septic type. This may be followed by acute dilatation of the left ventricle or of the entire heart, and it may be a cause of sudden death.

Digestive system.—Functional disturbances are very frequent, and, in fact, are seen in most of the cases, but organic changes are rare. Vomiting is the mode of onset in the majority of cases, but rarely continues through the attack. Late in the disease it is a frequent symptom of uræmia. Diarrhœa may be associated with it under both conditions. The tongue is nearly always coated, and clears off in quite a characteristic way, which, with the prominent papillæ, gives rise to the "strawberry" appearance. Catarrhal stomatitis is a very frequent complication, and in many cases of severe membranous angina the same process is seen in the buccal cavity.

Nervous system.—Nervous complications and sequelæ are seen less frequently with scarlatina than with most of the infectious diseases of such severity. Convulsions are frequent at the outset, and generally indicate a severe attack, though not invariably so. Occurring late in the disease, they are usually due to uræmia, and may be a cause of death. Meningitis may occur as a complication of otitis, in pyæmic cases, and sometimes with post-scarlatinal nephritis. Paralysis from peripheral neuritis is rarely seen. Hemiplegia sometimes occurs from meningeal hæmorrhage, or from embolism secondary to endocarditis and associated with nephritis. Chorea was noted as a sequel in only three of 533 cases reported by Carlslaw. In a report of 187 cases of epilepsy, Wildermuth states that it followed scarlet fever in 12 cases. Insanity has been occasionally observed, the usual form being acute mania, with complete recovery in a few weeks or months.

Gangrene.—Cases of symmetrical gangrene after scarlet fever have been reported by Wilson and others. The parts generally affected are the buttocks, thighs, and arms, but it may occur almost anywhere. The pathology of these cases is obscure. The process usually begins in several places simultaneously, or in rapid succession, and advances steadily till death occurs.

Other infectious diseases.—Scarlet fever is not very infrequently complicated by other forms of infectious disease. It is seen with diphtheria,

measles, varicella, erysipelas, and occasi
fever. The symptoms are an irregular
to the two diseases. They may begin sim
one develops as the other is subsiding.

Diagnosis.—The characteristic sympto
onset, usually with vomiting, the marke
erythematous condition of the throat, a
within twenty-four hours. Before the e
cated from tonsillitis or many other diseas
usually depend upon irregularities in the
its appearance and its character. These
est, and in the most severe cases. In th
not be above 100·5° F., the rash may last l
only upon the chest and neck, or there an
it does not cover the trunk and extremiti
nostic about these symptoms, even when
redness of the throat, which is by no mean
after them of desquamation is usually co
ever, this is of so uncertain a character th
of the disease, the diagnosis may remain
doubted exposure within a week prior to t
cases of scarlet fever subsequently develop
ly strengthens the diagnosis.

Cases of malignant scarlet fever which
istic eruption appears, can not be diagnostic
such cases are preceded or followed by oth
diagnosis can be made with a strong degree

The form of the disease in which the
severity and appear early, are often difficult
theria. Here the only reliable ground of
the bacteriological examination. There ar
appearances which are of some assistance
test. These are discussed in connection wit

The eruption of scarlet fever may be co
rubella, urticaria, and various forms of ery
of measles has little that suggests scarlet f
upon the face and spreading slowly over the
the eruption may resemble neither disease.
upon the other symptoms: the sudden on
fever, or the gradual onset with marked c
The eruption of rubella is more difficult t
the important thing is that, although the ra
covering the body, the constitutional symp
sent. In scarlet fever with an eruption of t

variably a considerable elevation of temperature, usually 102° to 103° F., and a bright red throat.

There are so many skin eruptions which may resemble that of scarlet fever, that it is always hazardous to make the diagnosis of this disease from the eruption alone. This is especially true of sporadic cases occurring in infants; there is seen at this age a great variety of eruptions, usually associated with digestive disturbances, which closely simulate a scarlatinal rash; but most of them are of short duration. A scarlatiniform erythema is occasionally seen in diphtheria, influenza, typhoid fever, and varicella, which may cause them to be mistaken for scarlet fever, or may lead to the diagnosis that both diseases are present. The same is the case with the septic erythema occurring in surgical patients. Belladonna, quinine, and occasionally antipyrine, may produce eruptions more or less closely resembling that of scarlet fever. This is also true of some cases of urticaria, and of several other forms of skin disease. There is little doubt that many of the cases reported as relapsing scarlatina are really examples of recurring erythema, particularly as some of the latter are followed by a desquamation which is very similar to that after scarlatina. In all doubtful conditions great importance is to be attached to the constitutional symptoms.

Prognosis.—The mortality of scarlet fever varies much in different epidemics. In some, nearly all the cases are of a mild type, and the mortality may be as low as 3 or 4 per cent; in others, a severe or malignant type prevails, and it may be as high as 40 per cent. The disease is, as a rule, more fatal in the youngest infants, becoming less so as age advances. This is well shown in two recent epidemics in the New York Infant Asylum. There were—

Under one year	29	cases;	mortality,	55	per cent.
From one to two years	37	"	"	22	"
" two " three "	28	"	"	7	"
Over three years	23	"	"	0	"

In the first epidemic the general mortality was 12·5 per cent; in the second it was 33 per cent, in the same class of children.

The following are the mortality records from various European sources:

Ashby, Manchester Hospital	681	cases;	mortality,	12·2	per cent.
Koren, a single epidemic	426	"	"	14·0	"
Bendz, Copenhagen	22,036	"	"	12·2	"
Ollivier, three Paris hospitals for five years	893	"	"	14·5	"
Fleischmann, five epidemics	1,356	"	"	10·0	"

The general mortality of the disease may therefore be assumed to be from 12 to 14 per cent; it is, however, much higher than this among young children, as shown by the following figures:

New York Infant Asylum...	116 cases	un
Ashby, Manchester Hospital.	259 “	“
Bendz....	not stated	“
Heubner....	136 cases	“
Fleischmann....	not stated	“

Under five years of age the averag
therefore, between 20 and 30 per cent.

The fatal cases may be grouped in
late nephritis, in which the early sympt
ate severity or even mild; secondly, th
with severe throat symptoms and dying
week from exhaustion, or from some loca
pneumonia, pleurisy, meningitis, or ne
cases, which are overpowered by the pois
or three days of the attack.

Prophylaxis.—Even the mildest cases
or until desquamation is completed. If c
rhinitis, pharyngitis, empyema, or supp
should be continued until these condition
be allowed to mingle with other children
symptoms have subsided, and should be
children for three months. Children in
exposed to the disease should be immedi
have been exposed, separately quarantin
recovery, the patient, before mingling wit
least two disinfectant baths, the entire bo
water and then washed in a solution of ca
(1 to 5,000), and every particle of clothi
should be cut short, and the scalp thoroug

The nurse should be quarantined wi
mingle with other members of the fami
clothing has been made, and hands and fa
nurse and all others in close contact with
septic gargle four or five times a day and a

The room should be in that part of the
usually on the top floor; during the attac
holstery, hangings, and carpet, should be
clean as possible, the floor being frequen
solution (1 to 1,000). The presence in
antiseptic fluids is of no practical value, an
ates a false sense of security. The same m
bolic or other solutions and hung about the
has been known to result from this practi
be remembered that the room is probably a

the patient. Smooth walls should be wiped with damp cloths wrung out of a bichloride solution (1 to 2,000), or should be rubbed down very carefully with bread. The wood-work should be washed in the same solution and the floor thoroughly scrubbed with it. After a severe case, the walls should be painted or whitewashed, or if papered, the wall-paper should invariably be renewed and the wood-work repainted. Simply airing a room after an attack is of little or no benefit. An instance is on record of a patient contracting the disease in a room in which the windows had been open constantly for three months. The carpets, bedding, hangings, and upholstery are best disinfected by steam. Where this is impossible, after a severe case they should be burned; after milder cases, articles which can be boiled should be treated in this manner, and others exposed to sunlight for a long time out of doors, or, after having been moistened, should be fumigated with sulphur in the sick-room. The mattress should be burned. As ordinarily employed, sulphur fumigation is of very doubtful efficacy, and should never be alone depended upon.

The bedclothes, linen, and clothing removed from the patient during an attack, should be put at once into a solution composed of zinc sulphate, four ounces, common salt, two ounces, and water, one gallon, and afterward boiled at least two hours in the same solution. Instead of handkerchiefs, pieces of old muslin, surgeon's gauze, or absorbent cotton, should be used for cleansing the nose and mouth of the patient and burned immediately.

The physician in attendance upon a case should leave his coat and overcoat in an anteroom, and put on a long gown or rubber coat, buttoning tightly at the neck and sufficiently large to cover all his clothing. This should always be worn in the sick-room, and boiled or disinfected when the case is finished. The physician's visit should not be unduly prolonged, and a stethoscope should be used for examining the chest. For a single visit the overcoat may be worn in the room, but the clothing should be changed before visits to other children are made. After every visit the physician's hands and face should be thoroughly washed with soap and then with a disinfectant solution.

A physician in attendance upon scarlatinal patients should not attend obstetric cases or other patients with recent wounds. The great liability of such cases to contract scarlatina should never be forgotten. If, in emergencies, it becomes necessary to attend such patients, the physician should change all his clothing and disinfect his hands, face, hair, and beard, with the greatest thoroughness.

Schools are the hot-beds for the spread of scarlet fever. The greatest sources of danger are the mild or walking cases in which the disease has not been recognised, and the clothing of patients who have had a severe form of the disease. As a rule, a child should be kept from school six weeks from the beginning of the attack, and the certificate of a physician

should be required before re-admission, st
mation is complete, but also that the child
Other children in the household should no
of any kind during the period of active
at home on the average for a month. Th
because they might carry the disease fron
because otherwise they might themselves
from the disease in a very mild form or
Where the sick child is completely isola
source is very slight. During severe ep
necessary to close all schools.

During desquamation the spread of t
prevented by the free use of inunctions
water should always be disinfected. All
should be disinfected throughout the dise
(1 to 20). If cases of scarlet fever are
be done only in a vehicle which can be easi
cumstances as few persons as possible sho
patient.

In general, it is to be remembered that
patient, secondly from the room, and thirdl
tention should always be given to the compl
the first case which appears in an institutio
apply to mild as well as the severe forms of

Treatment.—There is as yet no specifi
treatment is one of symptoms and complic
no medicine whatever. Children should b
week after the fever has subsided, and upon
weeks. This is an important matter in the
618). During the height of the eruption, t
may be allayed by sponging with a weak ca
unctions with vaseline, or by the free use of
air should always be secured in the sick-roo
rash have disappeared, daily warm baths w
used, after which the entire body should be
line or a one-per-cent ichthyol ointment, o
per cent strength, with the two-fold purpos
and disinfecting the scales. In case the s
treatment, bran baths may be substituted f
requires careful attention in all cases. W
above, it should be regulated as in other for

The temperature does not usually require
casionally rises to 104° or 104·5° F. But if th
perature which ranges from 103° to 105° F.

are called for. Cold is much safer and more certain than drugs. Sometimes cold sponging is sufficient, but in the great proportion of cases the cold pack or the cold bath (pages 47, 48) is required. The pack is almost as efficient as the bath, and usually meets with less opposition on the part of the parents. The use of cold in the reduction of temperature is especially indicated in septic cases with typhoid symptoms, and in those with pronounced cerebral symptoms. Where these are severe the bath should always be used, and repeated with sufficient frequency to keep the temperature below 103° F.

The nervous symptoms are frequently better controlled by ice to the head and by cold sponging than by medication. Antipyretic drugs may be relied upon to control restlessness and promote sleep, and in mild cases to effect a moderate reduction in temperature when this is accompanied by great discomfort. Phenacetine is usually to be preferred. For the nervous symptoms occurring in nephritis, as stated elsewhere, opium is to be used.

As soon as the pulse becomes weak or rapid and irregular, with a feeble first sound of the heart, stimulants should be given, no matter at what stage of the disease. In mild or moderately severe cases they are not generally required. In septic, or malignant cases, or in those accompanied by severe angina, adenitis, or cellulitis, alcoholic stimulants must be used fearlessly—carried even to the full toleration of the patient (page 49). Digitalis is next in value to alcohol, and is especially indicated where the pulse is weak and soft, with a low tension. The fluid extract may be given to a child five years old in minim doses, four times a day in the beginning, and later, if necessary, with greater frequency. Strychnine is also useful, and may be combined with digitalis or given separately, the usual initial dose being gr. $\frac{1}{100}$ to a child of five years.

The erythematous sore throat requires no treatment except the use of a mild antiseptic gargle. If there is profuse nasal discharge, nasal syringing (page 56) with a warm saline or boric-acid solution may be used with the hope of preventing infection of the middle ear. The local treatment of the membranous angina is the same as that of other cases of pseudo-diphtheria. Gangrenous inflammation of the tonsils or palate is sometimes benefited by injections of a 10-per-cent solution of carbolic acid in glycerin, but most such cases prove fatal, no matter what the treatment.

Milder forms of adenitis require no local treatment. When severe, an ice-bag should be applied in the case of older children. If this is not well borne, for young children a hot poultice may be used for a short time for the relief of pain. Prolonged poulticing, however, almost invariably does more harm than good, and favours suppuration. If abscess forms, early incision should be practised.

It is doubtful if otitis can be prevented by any form of local treatment. My experience has been that it rarely occurs in cases with mild throat symptoms, but that where these are severe it almost invariably follows, whatever the treatment employed. The indications, however, are to keep the rhino-pharynx as clean as possible by syringing the mouth and nose. The indications for paracentesis of the drum membrane are the same as in other severe forms of otitis (page 884). The treatment of scarlatinal nephritis has been considered in the chapter devoted to Diseases of the Kidney (page 618). Diffuse cellulitis of the neck calls for free incisions early as the only means of preventing extensive sloughing.

During convalescence, tonics, particularly iron and digitalis, are called for. The urine should be frequently examined for a long time; antiseptic gargles and a nasal spray or syringe should be used as long as a purulent discharge from the nose or pharynx continues.

CHAPTER II.

MEASLES.

Synonyms: Rubeola, Morbilli.

MEASLES is an epidemic contagious disease, more widely prevalent than any other eruptive fever; very few persons reach adult life without contracting it. One attack usually confers immunity. It is highly contagious even from the beginning of the invasion, and spreads with great rapidity from the patient to all susceptible persons exposed. The poison, however, does not cling so long to clothing or apartments as does that of scarlet fever. Measles has a period of incubation of from eleven to fourteen days; a gradual invasion of three or four days with symptoms of an acute coryza; a maculo-papular eruption which appears first upon the face and spreads slowly over the body, and which lasts from four to six days. This is followed by a fine bran-like desquamation, which is completed in about a week. The mortality is low, except among infants and delicate children, where it may reach 30 or even 40 per cent. In institutions for infants and young children no disease is more to be dreaded than measles, not only on account of its severity, but the frequency with which, in such subjects, it is complicated by broncho-pneumonia.

Etiology.—The essential cause of measles is as yet unknown. It is generally believed to be due to a micro-organism, but, as in the case of scarlatina, all attempts to isolate it have thus far been unsuccessful. The poison is one which possesses remarkable powers of diffusion, but whose viability is much less than that of most of the pathogenic germs which are known. Only a short exposure is required to communicate the disease, and even close proximity to a patient does not seem necessary. One instance has come under my own observation where measles was apparently conveyed by an exposure of half an hour across a hospital ward, a distance of at least fifteen feet.

Predisposition.—With the exception of young infants, children of all ages are extremely susceptible to measles. The disease broke out in a cottage of the New York Infant Asylum which was occupied by twenty-three children, nearly all of them being under two years old; only four escaped, all these being under five months old. In an epidemic reported by Smith and Dabney, 110 unprotected children, between the ages of eight and eighteen years, were exposed and only two escaped. In the Nursery and Child's Hospital, during the epidemic of 1892, there were 62 children over two years of age; five were protected by a previous attack and escaped; of the remaining 57 children, 55 took the disease. There were also in the institution 113 children under two years old; of this number 78 per cent took the disease; but although many were exposed, not one child under six months old contracted measles. The age of the persons affected depends much upon the length of time since the last outbreak of the disease. In an epidemic occurring in the Island of Guernsey, where the disease had not prevailed for many years, all ages were affected, the youngest being twelve days old, and the oldest, a man and wife, each aged eighty years. Somer has reported an instance of an eruption of measles appearing in a child twelve hours after birth; the mother was suffering from the disease at the time. Gautier has collected six additional cases, where measles either existed at the time of birth or developed within a few hours after it.

Except, then, in early infancy, the probabilities are very strong that every child exposed to measles will contract the disease. Occasionally, however, one is seen who seems insusceptible to the poison, no matter how close the exposure.

Epidemics of measles are more frequent and more severe during the spring months. They are least frequent and mildest during the autumn months.

Incubation.—In 144 cases,* where the period of incubation could be definitely traced, it was as follows:

Incubation of less than nine days	3 cases.
" " nine or ten days	22 "
" " eleven to fourteen days	95 "
" " fifteen to seventeen days	19 "
" " eighteen to twenty-two days	5 "

Thus in 66 per cent of the cases the incubation was between eleven and fourteen days, and in only one case was it less than a week. The constancy

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* About twenty-five of these are taken from my own records; the remainder are mainly isolated cases, scattered through medical literature. The incubation is reckoned from the time of exposure to the beginning of the catarrh.

of the incubation period is strikingly s
in the one reported by Smith and Dabr
exactly eleven days after the rash appe
developed in twenty children — no cas
terval.

Duration of the infective period.—
scarlet fever, and the average duration
Haig-Brown discharged fifty-eight cases
day of the disease, and in no instance w
dren. Ransom, however, records one in
cated thirty-one days after the appearanc

Measles is highly contagious from
symptoms. A case occurred in the Bab
servation, in which a child conveyed the
appeared. Ransom reports another prec
been related to me by Dr. S. W. Lambe
who were at a children's party, only one e
fection being a child who showed no ra
child who escaped had previously had m
contagion is still a matter of dispute, the
coincident with the highest temperature,
severe catarrhal symptoms.

With the fading of the eruption and t
communicability of measles diminishes
during desquamation, and soon after thi
gether. It is generally proportionate to
symptoms, and where these are protracted
may be communicated for a much longer

Mode of infection.—Measles is usually
infrequently through the medium of clothi
Townsend (Boston) records an instance i
a tenement house on the same day on w
family in which two children had suffe
fourteen and the other eighteen days pre
not fumigated nor disinfected, and, altho
children in the incoming family, they
Measles rarely if ever clings to apartment
scarlet fever. Many instances are on recor
carried by a third party ; but, after all, this
tact both with the sick and the well child
short. It is very seldom that measles is c
even the ordinary precautions. In a case r
of a patient is stated to have conveyed the
attack, but this must be regarded as very e

Lesions.—The only constant lesions of measles are those of the skin and the mucous membranes, chiefly of the respiratory tract. According to Neumann, the process in the skin is of an inflammatory character, but is more superficial than in scarlet fever. There is congestion, accompanied by an exudation of round cells about the small blood-vessels, and also about the sweat and sebaceous glands, and the papillæ. To this exudation and the œdema, the swelling of the skin is due. It occurs everywhere, but is especially noticeable upon the face.

The changes in the mucous membranes are quite as much a part of the disease as are those of the skin. There is a catarrhal inflammation affecting the conjunctivæ, nose, pharynx, larynx, trachea, and large bronchi, which varies in intensity with the severity of the attack. In the most severe forms in infants and in young children, this inflammation extends with great uniformity to the small bronchi, and usually to the air vesicles, causing broncho-pneumonia. In severe cases, the lesion in the pharynx and larynx also, instead of being catarrhal, may be membranous; the larynx being much more frequently involved, and the ears much less so, than in scarlet fever. The lesions of the lungs and of other organs will be more fully considered under Complications.

The bacteria which are associated with the lesions of the respiratory tract are, in the milder cases, usually the staphylococcus, and in the more severe ones the streptococcus, although this is sometimes reversed. They may be found separately or together, and either form may be associated with the pneumococcus (see Bacteriology of Broncho-Pneumonia, page 482). The poison of measles produces conditions in the mucous membranes of the respiratory tract which are especially favourable for the development of these bacteria, which at such times are always present in the mouth in large numbers. Many of the other complications besides pneumonia are due to infection with these germs. Associated with the lesions of the mucous membranes, are found changes in the lymphatic glands with which they are connected; they may be of a hyperplastic or of a suppurative character.

Symptoms.—*Invasion.*—As a rule, the invasion of measles is gradual, both the fever and catarrhal symptoms increasing steadily up to the appearance of the eruption. The characteristic symptoms of the invasion are those of a severe coryza,—suffusion of the eyes, increased lachrymation, photophobia, sneezing, and a discharge from the nose. The hoarse, hard cough indicates that the catarrhal process has involved the larynx and trachea, as well as the visible mucous membranes. Frequently the patient complains of some soreness of the throat, and on inspection there is seen moderate congestion of the tonsils, fauces, and pharynx. On the hard palate are frequently seen on the second or third day small red spots, from the size of a pin's head to that of a pea. This is sometimes spoken of as the eruption upon the mucous membrane. The constitutional symptoms

are indefinite, and may be met with in
dulness, headache, pains in the back, and
there is rarely vomiting or diarrhœa. D
and is regarded by the laity as characteris

The exceptional cases in which the i
There may be a sudden accession of fev
vulsions, as in a case lately under my obse
the disease prevails epidemically, the inv
and pulmonary symptoms which are so s
until the rash makes its appearance, the
regarded as one of primary pneumonia o
the stage of invasion—i. e., from the beg
eruption—in 270 cases of which I have no

1 day or less	35	cases.	6 da
2 days	47	"	7 "
3 "	64	"	8 "
4 "	64	"	9 "
5 "	29	"	10 "

From this table it will be seen that the
varies considerably,—more, I think, in in
(most of these were under three years ol
In the greater number of cases it lasts fro

Eruption.—The rash usually appears o
of the disease—in the largest number upo
is first seen behind the ears, on the neck,
the forehead. It appears as small, dark-r
scattered, and not elevated, resembling fle
the macules are much more numerous, a
papules. They frequently group themsel
are usually separated by areas of normal sk
they are frequently coalescent. From the
the full development of the rash on the
hours, but may be from one to three days.
considerable swelling of the face, especially
are sometimes scarcely recognisable. On
begins to appear upon the neck beneath t
chest and back; on the third day the trunk
are seen upon the extremities. The rash
tremities, and by the time it is fully out u
to fade from the face. In mild cases it
ones it is frequently confluent upon the face
of the extremities. As a rule, it covers th
and soles.

The eruption fades slowly in the order

left behind, in typical cases, a slight brownish staining of the skin, which often remains for nearly a week. The duration of the rash is from one to six days, the average being four days.

There are many cases in which the rash does not follow the typical course described: (1) Instead of spreading gradually, the entire body may be covered in a few hours. (2) The rash may be hæmorrhagic. This condition was present in about five per cent of my cases. The whole eruption may be hæmorrhagic, or it may be so only upon certain parts—usually the abdomen or extremities. Under such circumstances small petechial spots take the place of the macules. This is the "black measles" of the older writers. It is in most cases a bad, but by no means a fatal symptom. I have seen it in several cases that were not especially severe. (3) The rash may be very faint, and of short duration, being scarcely elevated at all. (4) It may consist of very minute papules, closely resembling the rash of scarlet fever. It is to be remembered, however, that the irregular eruptions of scarlet fever much more frequently resemble measles than *vice versa*. (5) It may be very scanty, and late in its appearance; particularly in cases of great severity and hyperpyrexia—the so-called malignant cases. (6) Temporary recession of the eruption may occur at any time during the height of the disease, and is usually due to heart failure. A recurrence of the eruption after it has run its usual course is something which I have never seen; although such cases have been reported, I believe them to be very exceptional.

During the first two days of the eruption, the local and constitutional symptoms increase in severity, both usually reaching their maximum at the time of the full development of the rash upon the face. The skin is swollen, and the seat of intense itching and burning. The eyes are very red and sensitive to light, and there is swelling of the conjunctivæ with an abundant production of mucus or muco-pus, causing the lids to adhere. There is pain on swallowing, also swelling of the glands at the angle of the jaw or in the post-cervical region. The cough is frequent and very annoying. There is complete anorexia, and often diarrhœa. The tongue is coated, and may show at its margin enlarged papillæ, resembling the "strawberry" appearance of scarlet fever. As the rash fades the temperature declines rapidly, often reaching the normal in two or three days. The catarrhal symptoms now subside, and soon the patient is convalescent. Within a day or two after the fever has ceased, the rash disappears.

Desquamation.—This begins almost as soon as the rash has subsided, and is first noticed on the face and neck, where the eruption first appeared. The nature of the desquamation is invariably fine, branny scales, never in large patches, as in scarlet fever. It is often quite indistinct and may be overlooked. Its usual duration is from five to ten days. It may, however, be prolonged for two weeks. The amount of desquamation varies

considerably in the different cases. It i
there has been an intense eruption. T
time an odour about the patient which i
During this stage the cough often persist
very sensitive to light, but in other resp
fectly well.

1. *The mild cases.*—The mildest cas
perature, which at the height of the erup
rarely lasts more than four days. The
never confluent. The swelling, itching,
are wanting, as is also the intense red c
frequently obscure, and, without the othe
diagnosis. The catarrhal symptoms are
these are very mild as compared with th
the rash is shorter, desquamation is scarc
complications.

2. *The cases of moderate severity.*—
more regular in children over three year
former, the symptoms of invasion come on
rises steadily until the appearance of the

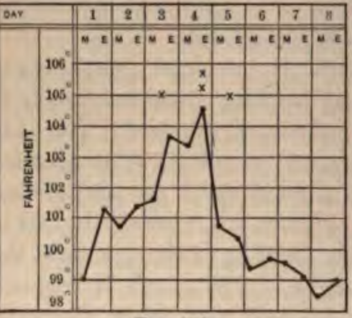

Fig. 158.

Fig. 158.—Temperature curve in uncomplicated measl
fall; patient ten years old; × = first eruption; ⁑ =
Fig. 159.—Typical curve in uncomplicated measles, wi
three years old.

on the third or fourth day of the disease
the typical temperature curve in average
curve was seen in 44 per cent of 173 cases
were made. Sometimes the decline in th
crisis, as in Fig. 158, but more often it fall
such cases the duration of the fever is from
being about a week. The other symptom
of the fever. The maximum temperature i

the full rash upon the face, at this time usually being in uncomplicated cases from 103° to 104° F. in older children, and 104° to 105° in infants and young children.

A not very uncommon temperature curve is that of Fig. 160, where the onset of the disease is marked by a sudden rise to 102° or even 104° F., with a fall nearly or quite to normal on the second day, after which the fever rises gradually, as in the first group. This curve was seen in 5 per cent of my cases.

3. *The severe cases.*—In Fig. 161 is shown a type of the disease which is more frequent in infants than in older children, the important features being the late eruption and the continuance of the high fever for several days after the rash has begun to fade. Such a prolonged course and so high a temperature are almost invariably due to some complication, usually bronchopneumonia. Where the pneumonia goes on to the production of areas of consolidation, the fever usually continues for three and sometimes for four weeks, even though terminating in recovery.

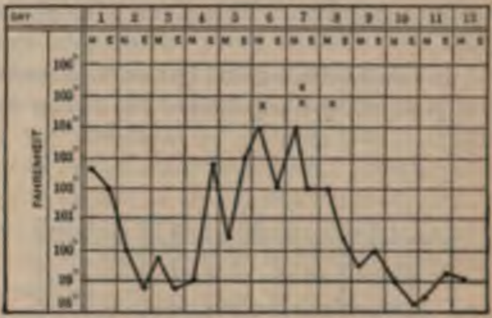

FIG. 160.—A not infrequent temperature curve in measles, showing abrupt invasion, but subsequent course typical; uncomplicated case; patient nine months old.

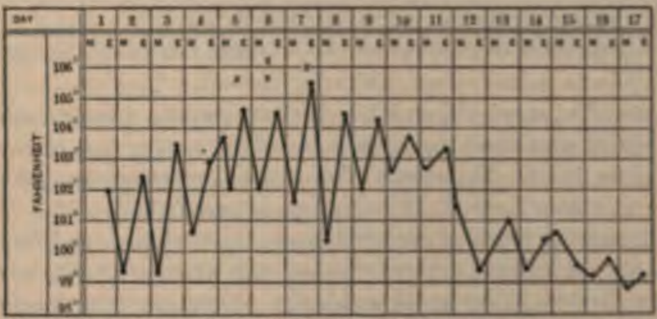

FIG. 161.—Measles with prolonged invasion; continuance of high temperature after full eruption due to severe bronchitis and diarrhœa; child two years old.

Figs. 162 and 163 illustrate two types of the disease which are often seen when measles is complicated by pneumonia. In cases like that shown in Fig. 162 the onset is abrupt with high temperature, prostration, and pulmonary symptoms not unlike those of primary pneumonia. A temperature curve resembling this was seen in 28 of 173 cases. The rash is often late in appearance; it is faint and altogether irregular; it may recede after the first day and reappear after an interval of one or two days. The catarrhal symptoms are not marked, but the whole force of the disease seems to be expended upon the lungs. The diagnosis of these cases presents great difficulties, and very often it would not be made but for the fact that there are other cases of measles in the family or the institution. This form is usually seen in infants, and it is very fatal.

In other cases marked by a sudden severe onset, the system seems to be overpowered by the poison of the disease itself. There are profound depression, and hyperpyrexia, and the patient may die from toxæmia with cerebral symptoms before the appearance of the rash or just as it is beginning to show itself. Sometimes the pulmonary symptoms are entirely wanting; at others the rash, if it appears, is hæmorrhagic.

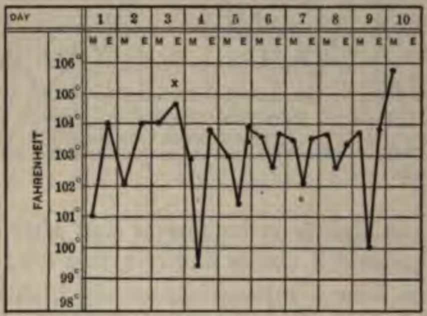

FIG. 162.

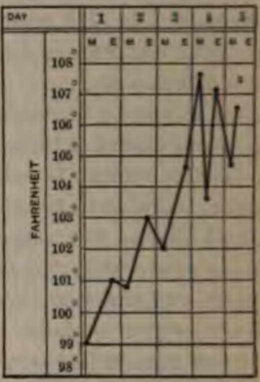

FIG. 163.

FIG. 162.—Fatal attack of measles, complicated by broncho-pneumonia; very severe symptoms from the onset; patient eighteen months old; death on tenth day.

FIG. 163.—Fatal attack of measles, complicated by broncho-pneumonia; early invasion mild, but rapid development of severe symptoms on fourth day; rash on last day; patient eight months old.

In still another group of cases the onset is not violent, and for the first two days the attack may appear to be of only average severity; but there may then develop, often quite suddenly, pulmonary symptoms of such intensity as to cause death within twenty-four hours. The eruption, if seen at all, is faint and not characteristic (Fig. 163).

A secondary rise in the temperature after it has once fallen to normal was seen in 8 of 173 cases, being due to the development of otitis, ileocolitis, or late pneumonia.

Complications and Sequelæ.—The most frequent and most important complication of measles is broncho-pneumonia, and next to this are ileocolitis, otitis, and membranous laryngitis. Most of the others are infrequent; all complications are relatively rare in children over four years old.

Lungs.—The greatest danger in measles arises from pulmonary complications, and the frequency is greatest in children under two years of age. In two epidemics in the Nursery and Child's Hospital, embracing about 300 cases, nearly all in children under three years old, broncho-pneumonia occurred in about 40 per cent of the cases. Of those who had pneumonia, 70 per cent died. Fortunately, such a record as this is never seen outside of asylums or hospitals for young children. Of 2,477 cases, embracing several epidemics of measles among children of all ages, pneumonia occurred in 10 per cent. My own experience in the post-mortem room fully bears out the statement of Henoch, that a certain amount of pneumonia is found in almost every fatal case. Pneumonia is more frequent and its mortality is higher in spring and winter epidemics than in those occurring at other seasons. It may develop at any time from the beginning of invasion until convalescence, but it most frequently begins about the time of full eruption.

Lobar pneumonia, although rare, occasionally occurs as a complication in children over three years old. In some epidemics many of the cases of pneumonia are complicated by severe pleurisy, which adds much to the danger of the disease. This form is frequently followed by empyema. Pneumonia is always to be suspected when the temperature continues high after the full appearance of the rash.

Bronchitis of the large tubes, always accompanied by tracheitis, is seen in every case of measles, possibly excepting a few of the very mildest. This is so constant a feature as hardly to be ranked as a complication. In nearly all of the severe cases the bronchitis extends to the medium-sized and smaller tubes.

Larynx.—A mild catarrhal laryngitis accompanies almost every case of measles. Severe catarrhal laryngitis is present in about ten per cent of the cases; it may give symptoms which closely resemble those of membranous laryngitis, and the two are no doubt often confused. (For the points of differential diagnosis see page 443.)

Membranous laryngitis is more often seen as a complication of measles than of scarlet fever. It was present in 35 of 2,837 cases taken from miscellaneous sources; but in epidemics in institutions it is much more common than this. As a cause of death in older children it ranks next to pneumonia. When it develops at the height of the disease, as it usually does, it is due in nearly all cases to the streptococcus; but when it develops at a later period, it is usually due to the diphtheria bacillus. The streptococcus inflammation is in most cases associated with similar changes in the pharynx or tonsils, but not always. True diphtheria, occurring as a complication of measles, not infrequently begins in the larynx. The streptococcus inflammation may be as serious in this connection as is true diphtheria, from the probability, which amounts almost to a certainty, of the development of broncho-pneumonia. No complication is more to be dreaded than this. The diagnosis between the true and pseudo-diphtheria may sometimes be made by the time of development, but only with certainty by cultures. I once saw in measles, where no false membrane was present in the rest of the larynx, a necrotic inflammation with almost entire destruction of the vocal cords—a condition which may be compared to that seen in the tonsils or epiglottis in scarlatina.

Throat.—A catarrhal angina is part of the disease, and is as characteristic of measles as is the eruption upon the skin. There is acute congestion and swelling of the tonsils, uvula, palate, and pharynx. In a certain proportion of cases, very much less frequently than in scarlatina, the development of membranous patches is seen upon the tonsils and adjacent mucous membranes. These occur in two or three per cent of the cases. They are to be regarded in the same light as similar conditions complicating scarlet fever (page 899), with these differences, that in measles there is much greater likelihood of the extension of the disease to the larynx, while extension to the nose and ears is much less probable. True diphtheria, however, may complicate measles, and cases of membranous inflammation of the tonsils or pharynx developing late in measles are usually due to the Loeffler bacillus.

Although in most cases the inflammations of the pharynx and tonsils which accompany measles are not serious when they are due to the streptococcus, they are sometimes quite as severe as any that accompany scarlet fever. They may cause death from general sepsis apart from any affection of the larynx.

Digestive system.—Gastric disorders are not more common than in other febrile diseases; but diarrhœa is very frequent, and in summer it may be even more serious than the pulmonary complications. All forms of diarrhœa are seen, from that which results from simple indigestion to the severe types of ileo-colitis. This complication is most often seen in children under two years old. The most severe intestinal symptoms are not usually seen at the height of the primary fever; but, beginning at this time, they often increase in severity, and are most marked in the second and third weeks of the disease.

Catarrhal stomatitis is present in almost every case of measles; less frequently the herpetic form is seen. Ulcerative stomatitis is not uncommon, particularly in institutions. One of the worst complications of measles, but fortunately a rare one, is gangrenous stomatitis, or noma. This usually occurs in inmates of institutions, or in children with bad surroundings who were previously in wretched condition. It is nearly always fatal.

Gangrenous inflammations of other parts of the body are sometimes seen after measles, especially of the vulva or the prepuce.

Nervous system.—I have seen convulsions at the onset of measles in but a single case. During the progress of the disease they are not so rare, and may occur in connection with otitis, meningitis, or severe bronchopneumonia—chiefly in infants.

Meningitis is rare, but either the simple or the tuberculous form may occur, more often, however, as a sequel than as a complication. Insanity, usually of a temporary character, occasionally follows measles. In the epidemic of 108 cases reported by Smith and Dabney, insanity was noted three times, all the cases terminating in recovery. Epilepsy and chorea are rare sequelæ.

Ears.—Otitis is not so frequent as in scarlet fever, and in many epidemics it rarely occurs; in others it is often seen. In one hospital epidemic it was noted in 14 per cent of the cases. This epidemic occurred in early spring and affected very small children, both of which circumstances are favourable for the development of otitis. Usually both ears are affected, and the inflammation terminates in suppuration; but the otitis of measles is, as a rule, much less serious than that of scarlet fever, and much less frequently leads to permanent impairment of hearing.

Eyes.—Simple catarrhal conjunctivitis accompanies nearly every case of measles. In the severe form there is a muco-purulent catarrh, which may attain any degree of severity. In neglected cases, and among children who are poorly nourished, especially in asylums, the disease is apt to extend to the cornea. In a very large number of cases chronic conjunctivitis persists after measles, particularly in the class of children just mentioned.

Lymph nodes.—Swelling of the lymphatic glands of the neck is frequent, but not generally severe, and rarely terminates in suppuration. In a considerable proportion of cases chronic enlargement persists for months, and sometimes the glands may become tuberculous. Similar changes and similar consequences may occur in the glands of the tracheo-bronchial group.

Kidneys.—The infrequency of renal complications in measles is in striking contrast to scarlet fever. Transient febrile albuminuria is not uncommon, but a serious degree of nephritis, either clinically or at autopsy, I have never seen, and literature furnishes but few cases. Demme and Browning have each reported cases of nephritis following measles, in which death occurred from uræmia.

Heart.—Both endocarditis and pericarditis have occurred in the course of measles, but they belong to the rare complications. The same may be said of changes in the muscular walls of the heart.

Skin.—As complications, erysipelas, furunculosis, impetigo, and pemphigus have been noted; but all are rare.

Hæmorrhages.—Associated with the hæmorrhagic type of the eruption, severe and even fatal hæmorrhages may occur from the mucous membranes, and the latter are sometimes seen without the hæmorrhagic eruption.

Other infectious diseases.—Measles may be complicated by almost any of the other infectious diseases—scarlet fever, varicella, diphtheria, etc. It is rare that the two diseases are exactly simultaneous, but one usually develops as the other is subsiding. Epidemics of measles and whooping-cough more frequently occur together, or follow each other, than do any of the others. The relation of measles to tuberculosis seems to be particularly close. In some of the cases, tuberculosis follows directly in the wake of measles, an irregular temperature continuing from three to eight weeks, when death occurs from general tuberculosis with the principal lesions in the lungs. Acute miliary tuberculosis may follow even more closely. As a late manifestation, the most common one is tuberculosis of the bones, occurring as hip-joint disease, caries of the spine, etc. The relation of measles to tuberculosis seems to be that it furnishes conditions, especially in the lungs, which are favourable for the development of tuberculosis in patients who have been previously infected, but in whom the disease has been latent in some part of the body, especially in the lymph nodes. In other cases measles seems greatly to increase the susceptibility of the patient, so that tuberculosis is subsequently contracted after the slightest exposure. The frequent association of these diseases should never be forgotten, and on this account an attack of measles in a child with tuberculous antecedents should always be looked upon with apprehension.

Diagnosis.—The most important symptoms for diagnosis are the coryza, at first slight, but steadily increasing in severity, the gradual rise in temperature, and the maculo-papular eruption, appearing first upon the neck and face, and slowly extending over the body. Before the rash a diagnosis is impossible. When it is faint and of doubtful character, a hot mustard bath will often bring it out so distinctly as to make a diagnosis easy. In cases where the rash is irregular in its character or time of appearance, great importance is to be attached to the catarrhal symptoms, especially the condition of the eyes. The appearance of the throat and the fine red spots upon the hard palate are also important. The cases which present the greatest difficulties are the very severe ones and those in infants. Mild attacks are more characteristic than are the mild forms of scarlet fever.

From skin diseases, measles is distinguished by its temperature, which is rarely less than 102·5° F. at the height of the eruption; from other general diseases by the rash itself.

Prognosis.—This depends upon the age and previous condition of the patient, the character of the epidemic, and the season of the year at which it occurs. Except in children under three years of age, the deaths from measles are few; but in institutions containing little children, no epidemic disease is so fatal. The following statistics illustrate the general mortality of the disease as it has been observed:

Krauss and Hirschberg, Dresden Hospital, 49 years	1,461	cases;	mortality,	4·2	per cent.
Sagoiski, St. Petersburg Hospital, 11 years	7,050	"	"	9·2	"
Embden, one epidemic	461	"	"	6·7	"
Demme, Berne Hospital, in one epidemic	224	"	"	5·8	"
Alteberg, one epidemic	725	"	"	1·2	"
Fleischmann	736	"	"	22·0	"
Bendz, Copenhagen	30,581	"	"	3·0	"

The average mortality of the disease is thus from four to six per cent; but in epidemics observed in institutions containing only young children it is much higher. Henoch records an epidemic of 294 cases among children, nearly one half of whom were under two years of age, with a mortality of 30 per cent. In the epidemic of 1892, in the Nursery and Child's Hospital, New York, there were 143 cases, with a mortality of 35 per cent. The figures of the epidemic of 1895 were almost identical. All these children were inmates of the institution at the time they were taken ill, and, although many were delicate, few were suffering from other diseases when they were attacked with measles. The following table gives the exact figures of the epidemic of 1892:

From six to twelve months	42	cases;	mortality,	33	per cent.
" one to two years	51	"	"	50	"
" two to three years	27	"	"	30	"
" three to four years	20	"	"	14	"
" four to five years	3	"	"	0	"

The average mortality among children under two years is probably not far from 20 per cent, but it is much higher in institutions. The death-rate diminishes rapidly after the second year.

In any single case the important symptoms for prognosis are the temperature and the character of the eruption. An initial temperature above 103° F., or one which remains high until the eruption appears, is a bad symptom. So also is one which rises after a full eruption, or which does not fall as the rash fades. The following table shows the highest temperature and mortality in 161 hospital cases:

Highest temperature not over 102°	6	cases;	mortality,	0	per cent.
" " 102° to 103·5°	14	"	"	7	"
" " 104° " 104·5°	49	"	"	16	"
" " 105° " 105·5°	65	"	"	40	"
" " 106° or over	27	"	"	80	"

A favourable eruption is one of a bright colour, covering the body, remaining discrete, and spreading gradually. It is unfavourable for the eruption to appear late, to be very faint, scanty, or hæmorrhagic, or to recede suddenly, as this is usually due to a weak heart.

Of 51 fatal cases, the cause of death was broncho-pneumonia in 45, ileo-colitis in 4, and membranous laryngitis in 2. More than half the deaths occurred during the second week, the earliest being upon the fifth day of the disease.

The ultimate result of an attack of measles may not be evident for some time. Cases in which the temperature persists for two or three weeks without assignable cause after the disease is apparently over, should be watched with the greatest solicitude. The explanation of this is most frequently to be found in the lungs, although the physical signs are often obscure. The condition may be either subacute pneumonia or pulmonary tuberculosis. Even though the attack of measles may not have been in itself severe, seeds are often sown the full fruits of which are not seen until long afterward. Chronic glandular enlargements which may or may not be tuberculous, chronic bronchitis, chronic laryngitis, subacute or chronic nasal catarrh, hypertrophy of the tonsils, and adenoid growths of the pharynx,—all are frequent sequelæ.

Prophylaxis.—Measles is often regarded by the laity as so mild a disease that its prevention is thought of little importance, and no effort is made to limit its extension. The great probability that every person at some time in his life will have the disease, is no justification of unnecessary exposure. Although in older children measles is usually mild, this is not so in infants, who should be carefully protected from exposure. Special care should also be taken to avoid the exposure of delicate children or those with a strong tendency to pulmonary disease or to tuberculosis. In institutions it is of the utmost importance to secure prompt and complete isolation of the first case which appears.

The disease being usually spread by the patient and rarely from apartments, it follows that while early isolation is more important, there is not required the same thorough cleansing and disinfection which should follow every case of scarlet fever. In an institution, the ward or cottage from which a case has been removed should be quarantined for at least sixteen days after the appearance of the last case, and absolute security can not be said to exist until the end of three weeks. The same rule should be applied in private families where children who have been exposed should be quarantined apart from the patient, but not sent away. Under ordinary circumstances the quarantine of a case of measles should last four weeks from the beginning of invasion. It should be continued longer if there is pneumonia, otitis, or a nasal discharge.

Thorough cleansing and disinfection of the sick-room should be done before it is again occupied by children, and it should remain vacant at least two weeks. Children should be kept from all schools while the disease is in their homes, chiefly because they are otherwise liable to spread the disease while suffering from the early symptoms of invasion.

Treatment.—Measles is a self-limited disease, and there are no known measures by which it can be aborted, its course shortened, or its severity lessened. The indications are therefore to treat serious symptoms as they arise, and, as far as possible, to prevent complications, which are the principal cause of death.

The sick-room should be darkened, as the eyes are very sensitive to light. Every child with measles should be put to bed and kept there with light covering during the entire febrile period. There can be no possible advantage in causing a child to swelter by thick blankets, under the delusion that the disease may be modified thereby. The food should be light, fluid, and given at regular intervals. If the conjunctivitis is severe, iced cloths should be applied to the eyes, which should be kept clean by the frequent use of a saturated solution of boric acid, the lids being prevented from adhering by the application of vaseline or simple ointment. The intense itching and burning of the skin may be relieved by inunctions of plain or carbolized vaseline. The cough, when distressing, may be allayed by small doses of opium, either in the form of the brown mixture or by equal parts of paregoric and glycerin, of which from five to thirty drops may be given, according to the age of the child, every two hours. The restlessness, headache, and the general discomfort which accompany the height of the fever may be relieved by an occasional dose of phenacetine or antipyrine. As soon as the rash has subsided, a daily warm bath should be given, followed by inunctions to facilitate desquamation and prevent the dissemination of the fine scales.

The important indications to be met in the severe cases are very high temperature, cardiac depression, and nervous symptoms—dulness, stupor, sometimes coma, or convulsions. In some of the cases there are in addition dyspnœa and cyanosis, showing severe acute pulmonary congestion. For the nervous symptoms and high temperature, nothing is so reliable as the cold baths or packs (pages 47 and 48) and the nearly continuous use of ice to the head. I do not think there is any evidence that the use of cold increases the liability to pneumonia; but cold extremities, feeble pulse, and cyanosis, when associated with high temperature, call for the hot mustard bath, although ice should still be applied to the head. The indications for stimulants and the methods of using them are the same as in bronchopneumonia (page 510), which is usually present in cases requiring them.

To diminish the chances of pneumonia, it is necessary that every patient should be kept in bed during the attack, and care exercised to avoid exposure; that the chest should be protected with flannel and rubbed daily with oil. But still more important is it in hospitals and institutions where most of the cases of pneumonia occur, to allow the patients plenty of air space, never crowding them together in small wards. If possible, cases complicated by pneumonia should be separated from simple cases. From the fact that the pneumococcus and the streptococcus are found in the mouth so constantly and in such numbers in cases complicated by pneumonia, Méry and Boulloque have suggested systematic disinfection of the mouth several times a day, with the purpose of preventing this complication. There is reason in this suggestion, although its efficacy has not yet been put to a practical test.

The bronchitis and broncho-pneumoni
as in cases where they occur as primary
measles furnishes no new indications. Th
conjunctivitis, and otitis. Membranous
sillitis should be treated like other cases
cultures show the presence of the diphthe
treated like one of ordinary diphtheria in t

During convalescence the eyes should
least several weeks. Should the cough an
without physical signs in the chest, the pat
away to a warm, dry, elevated district, as t
is always to be feared. Cod-liver oil s
throughout the succeeding cool season, an
according to indications. The cough itself
follows an ordinary bronchitis (page 470),
useful than any other drug.

CHAPTER II

RUBELLA.

Synonyms: German measle

Rubella is a contagious eruptive feve
when prevailing epidemically. It is chara
with mild, indefinite symptoms, usually lasti
eruption which is generally well marked but
constitutional symptoms are very mild, and t
not often being even serious. For a long
with measles and scarlet fever, as the erupt
and sometimes the other disease. Its iden
and, as Strümpell well says, its existence is
have never seen it. The following peculi
Griffith (Philadelphia), who has written mo
other American writer, and to whom I am in
article:

(1) Rubella is a contagious, eruptive fever
of the skin; (2) it prevails independently e
fever; (3) its incubation, eruption, invasion,
ally from those of both these diseases; (4) it
with equal severity those who have had m
those who have not, nor does it protect in
them; (5) it never produces anything but r
contagion; (6) it occurs but once in the indi

Etiology.—Rubella is beyond question contagious, but is decidedly less so than either measles or scarlet fever; so that some observers have doubted its contagion altogether. It can be communicated at any time during its course, but is especially contagious during the early stage. Epidemics usually prevail in the winter or spring. As in the other eruptive fevers, a striking immunity is seen in infants under six months old; but, with this exception, all ages are liable to the disease.

The incubation of rubella varies considerably; the usual period is from eight to sixteen days, although the limits are from five to twenty-two days.

Symptoms.—*Invasion.*—This is rarely more than half a day, and in many cases no prodromata whatever are noticed, the rash being the first thing to attract attention. In a few cases there are mild catarrhal symptoms, with general *malaise* and slight fever. At other times there may be vomiting, convulsions, delirium, epistaxis, rigors, headache, or dizziness; but all are to be regarded as very exceptional.

Eruption.—Frequently a child wakes in the morning covered with the rash, no symptoms having been previously noticed. It generally appears first upon the face, and spreads rapidly to the whole body, the lower extremities being last covered. Less than a day is usually required for its full development. Exceptionally the eruption comes first upon the chest and back, and sometimes nearly the whole body is covered almost at once. The rash has occasionally been observed in the roof of the mouth before it was visible on the face. In a considerable number of cases the entire body is not covered; but the rash is more constantly seen upon the face than upon any other part.

Its character is subject to considerable variation. The eruption is most frequently composed of very small maculo-papules; they are of a pale-red colour, and vary in size from a pin's head to a pea. The spots are usually discrete, but may cover the greater part of the body where it is seen. On the face it is frequently confluent, and often appears here as large, irregular blotches of a red colour. From this description the rash will be seen to resemble that of measles more than that of any other disease. Very often, however, there is a tolerably uniform red blush which bears a close resemblance to the rash of scarlet fever; but even in such cases there will nearly always be found upon some part of the body, usually the wrists, fingers, or forehead, some typical maculo-papules. Between these two extremes all variations are seen. The colour of the eruption is sometimes dark red, and rarely it has been noted to be hæmorrhagic. The degree of elevation above the surface is also variable; sometimes this is so marked as to give to the skin a "shotty" feel, while in others the elevation is scarcely perceptible. The duration of the eruption is usually three days. Occasionally it lasts only two days, and it may last but one; it is rare for it to remain as long as four days. It fades in the order of its appearance,

and more rapidly than the eruption of me
tation of the skin sometimes remains for a

The highest temperature is coincident
not usually exceed 102°, and often it is on
perature continues but two days, falling
often the fall to normal is abrupt. Rarely
the fever lasts for four or five days, being 1
sion, and rising to 104° or 105° F. during
symptoms are in most cases even less mark
catarrhal symptoms resembling a mild att
sore throat suggesting mild scarlet fever;
are absent. The eruption is usually out
signs of disease.

Swelling of the post-cervical glands i
tures of rubella. In most epidemics it is se
symptom for differential diagnosis it is no
not uncommon in measles. The glandular
height of the disease; it is never very grea
suppuration. Both vomiting and diarrhœa
and itching of the skin are occasionally pre
than in scarlet fever or measles.

Desquamation.—This is always slight,
lasting from one to five days. In many cas
the most careful examination, and occasi
Writers who have observed some fairly typi
desquamation did not occur.

Complications and Sequelæ.—A characte
absence both of complications and sequel
cases none are seen. Isolated instances hav
occurred, severe bronchitis or pneumonia, se
buminuria, diarrhœa, phlyctenular conjuncti
erysipelas, and urticaria; but all are to be r

Prognosis.—There are few diseases so
A fatal termination is extremely rare, and
complications. Squire makes the significa
tality reaches three per cent the disease is n

Diagnosis.—The principal interest attac
nosis. This is a matter of extreme difficult
bility. The most characteristic thing abou
eruption with very few other symptoms. C
scarlet fever or mild measles that the differ
possible; it must be made from the surround
ease is prevailing epidemically. Scarlet feve
abundant rash should always be regarded

sles with a doubtful or absent catarrh. These difficulties in diagnosis can be appreciated only by one who has seen epidemics of measles and scarlet fever in institutions, and has watched the mild course of undoubted cases of these diseases which have there occurred.

It is never safe to make the diagnosis of rubella unless the disease is prevailing epidemically. Sporadic cases in which the diagnosis is made are, I believe, almost invariably instances of mild measles or scarlet fever. The first cases of rubella in an epidemic thus become difficult of recognition and are often overlooked. The continued absence in succeeding cases of the characteristic symptoms and complications of measles or scarlet fever should suggest to the physician that he is probably dealing with rubella.

Treatment.—None whatever is required for the disease excepting isolation, and even this is not imperative. The individual symptoms and complications are to be met with as they arise.

CHAPTER IV.

VARICELLA.

Synonym: Chicken-pox.

VARICELLA is an acute, contagious disease, characterized by a cutaneous eruption of papules and vesicles and by mild constitutional symptoms, serious complications and sequelæ being very rare. Although long confounded with varioloid, its existence as a distinct disease has been generally admitted for many years.

Etiology.—It is well established that the contagium of the disease is contained in the vesicles, as it may be communicated by inoculation with their contents. The specific poison, however, has not yet been isolated. Varicella is contracted by exposure to another case or through the medium of a third person. It affects children of all ages, one attack being as a rule protective. It is very contagious, resembling measles in this respect. The duration of incubation is quite uniformly from fourteen to sixteen days.

Symptoms.—Slight fever and general indisposition may be noticed for twenty-four hours before the appearance of the eruption, but in most cases the eruption is the first symptom. It usually appears first upon the face, scalp, or shoulders, as small, red, widely-scattered papules, and spreads slowly over the trunk and extremities. The papules in most cases come in crops, new ones continuing to appear for three or four days, even upon the same part of the body. The earlier ones have generally begun to dry up by the time the later ones appear, so that all stages of the eruption may be present at one time in the same region, this being one of its most

diagnostic features. The papules are at fir
crease in size, and are surrounded by an ar
inch in width. Many of them go no furth
jority become vesicular. The vesicles are u
in size—the largest, being about one fourth
process of drying up generally begins at th
depression, giving the vesicle a somewhat
areola is most distinct at the time of the
as the latter dries. Crusts now form, which
days, depending upon the depth to which t
the majority of cases no mark is left, but
where the true skin has been involved, s
there is quite deep pitting. Such marks ar
likely to occur upon the face.

Sometimes, especially upon hands and f
having been preceded by a papule; often t
cle resembles a drop of water upon healthy
are not seen, but they may develop in conse
tion, the result of scratching, or in childr
Under these circumstances deeper ulceratio
In rare cases there may be a necrotic inflam
pock, a condition to which is sometimes gi
nosa. It is not peculiar to varicella, and is
head of Gangrenous Dermatitis (page 872).

The pocks are usually most abundant ove
their number is in proportion to the seve
cases only twenty or thirty may be found
severe cases the skin may in certain regions
tion is never confluent. The pocks are al
hairy scalp, and frequently three or four m
membrane of the mouth or pharynx,—a po
In the latter situation the appearance is fi
superficial ulcer resembling that of herpetic

The temperature is highest when the eru
ing, this usually being the second or third
reaches only 101° or 102° F., and lasts but
may rise to 104° or 105° F., and last for fou
ally to normal as the rash fades. The ot
not characteristic. There is no coryza, co
but instead only the general indisposition w
disorder.

Complications.—The most serious comp
develops about the pocks, particularly when
with some ulceration. I have known of thre

Adenitis, either simple or suppurative, and abscesses in the cellular tissue, are occasionally seen. Nephritis is very infrequent, but a number of cases are recorded. It may occur at the height of the disease, but more often at a later period, like the nephritis of scarlet fever. Varicella is quite frequently complicated by other infectious diseases. In the New York Infant Asylum epidemics of varicella and scarlet fever at one time occurred together, and in at least a dozen children both diseases were seen at the same time.

Diagnosis.—The diagnosis of varicella is usually easy, provided the following points are kept in mind: First, that the eruption comes out slowly and in crops, so that papules, vesicles, and crusts may be seen upon the skin in close proximity; secondly, that the umbilication is due only to the mode of drying up of the vesicle, which begins at the center; thirdly, the appearance of the pocks upon the mucous membranes, and the history of exposure. It is distinguished from urticaria and other forms of skin disease by the presence of fever.

Treatment.—Although it is usually a trivial disease, isolation of cases of varicella should be enforced in schools and in institutions containing many infants. In the home, unless the other children are delicate or in poor condition, quarantine is unnecessary. The disease may probably be conveyed as long as the crusts are present, hence isolation should be maintained until they have fallen off. In most cases constitutional symptoms of the disease are so mild as to require no treatment.

Locally, the itching, when annoying, may be allayed by sponging with a weak solution of carbolic acid or the use of carbolized vaseline. When the crusts have formed, this ointment or vaseline containing two per cent ichthyol should be applied. Care is necessary to keep the skin clean, and, in the case of infants, to prevent scratching. In severe cases the urine should invariably be examined.

CHAPTER V.

VACCINIA—VACCINATION.

VACCINIA (cowpox) is a febrile disease induced in man by inoculation with the virus obtained either directly from the cow (bovine virus) or from a person who has been inoculated (humanized virus). The disease is not contagious in the ordinary sense of the term, but is communicated by inoculation either accidental or intentional.

The nature of the protection against smallpox which vaccination affords is even now but imperfectly understood. The fact, however, remains one of the best attested in medical history. It is the imperative duty of the physician to see to it that every young infant is vaccinated, and no foolish sentiment or prejudice on the part of the parents should be allowed to stand in the way.

Re-vaccination.—Regarding the duration of the protective power of a single vaccination, positive statements are impossible. Nearly all writers are agreed that vaccination should be done in infancy, again at puberty, and a third time at about the age of twenty or twenty-five. Many also insist upon re-vaccination at about the seventh year. It is a safe rule when smallpox is prevalent to vaccinate every person who has not been successfully vaccinated within five years.

Choice of Virus.—Modern experience is quite unanimous in the substitution of bovine for humanized virus, the advantages being that the lymph is much more likely to be obtained pure, uncontaminated by the germs of erysipelas or suppuration, and that the risk of transmitting syphilis is thereby avoided. There is now no difficulty in obtaining the ivory or quill points used for the preservation of bovine virus. There are many vaccine farms which can be depended upon for the purity and freshness of the virus which they supply.*

Time for Vaccinating.—In selecting a time for vaccination, the child's age and general health must be taken into consideration. It is pretty well established that the constitutional disturbance is much less in infancy than in later childhood, and less in very young infants (under one month) than in those of five or six months. Wolff states that of forty-two infants successfully vaccinated during the first week of life, not one showed any constitutional disturbance; after the fifth month, however, febrile symptoms were invariably present, and occasionally severe. A good rule for general practice is to vaccinate every healthy infant as soon as it begins to gain regularly in weight, this being in most cases during the first two months of life. In delicate infants or in those whose nutrition is a matter of great difficulty, those who are syphilitic, those suffering from eczema or any other form of active skin disease, vaccination should be deferred until the child is in good condition, unless it is likely to be exposed to smallpox. As a rule, vaccination should be avoided during dentition.

Methods of Vaccinating.—In my experience it is better to vaccinate in one place rather than to make two or three inoculations. Either the leg or the arm may be chosen; in young infants it is usually easier to protect the vaccine sore upon the leg than upon the arm. The point selected for inoculation should be either the outer aspect of the left calf, about the junction of the middle with the upper third of the leg, or the insertion of the left deltoid. The skin should be washed with soap and water, dried, and then washed with alcohol. With an ordinary large-sized cambric needle, which should be a new one, three or four scratches should be made a quarter of an inch long, and these crossed by as many more, just deeply enough to draw blood. The moistened vaccine point is now thoroughly rubbed for a full minute over the wound. After this has dried thoroughly the part may be covered with isinglass plaster moistened in boiled water, although if thorough drying has taken place the plaster is not necessary. The needle should not be used for a second child. The vaccinated limb should not be washed for twenty-four hours.

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* My own experience with that of the New England Vaccine Company of Massachusetts has been extremely satisfactory.

The Normal Course of Vaccinia.—The course of a proper vaccination-pock is quite uniform, and one which does not follow this course should not be considered protective. The original wound heals like any other scratch, nothing of importance being seen until the fourth or fifth day, when a slight areola is visible about the site of inoculation, which enlarges until it is an inch or two in diameter. Then there rises a vesicle, sometimes two, which afterward coalesce. The vesicle is from one fourth to one half an inch in diameter, and has a depressed centre (Fig. 164). By the ninth or tenth day the fully-formed vesicle is seen. The areola is now two or three inches wide, and there is more or less swelling. The lymph nodes in the axilla, or in the groin if the leg has been inoculated, are slightly swollen, tender, and sometimes painful. The vaccine pock changes but slightly for a day or two, after which, usually upon the eleventh day, the areola fades, the vesicle ruptures and discharges, or dries to a crust, this process occupying about two days. The crust remains for from one to three weeks, when it falls off leaving a smooth bluish scar which afterward fades to a white, and becomes somewhat honeycombed.

In some cases the symptoms are more severe. There may be swelling of the whole limb and marked pain. The original vesicle may be two or three times as large as usual, and secondary vesicles may form in the neighbourhood (Fig. 165). The inflammation may extend deeply into the subcutaneous tissue, and it may be followed by suppuration or even sloughing. There is then left an ugly ulcer, sometimes an inch wide and one fourth of an inch deep, to be filled slowly by granulation. In such cases the whole course of the disease may be from five to eight weeks.

If in a young infant the first inoculation is unsuccessful, at least three trials should be made with good virus, and in the event of further failure, after a year vaccination should be repeated. A failure to inoculate does not mean insusceptibility to smallpox, as is often popularly believed, but most frequently arises from the fact that the virus is inert. I have known one case in which the seventh, and another in which the thirteenth, inoculation was successful after previous failures; occasionally there are seen children who can not be inoculated at all.

Constitutional symptoms, as previously stated, are often absent in the case of very young infants; but in others there is quite constantly present a fever which runs a fairly regular course. It usually begins on the fourth

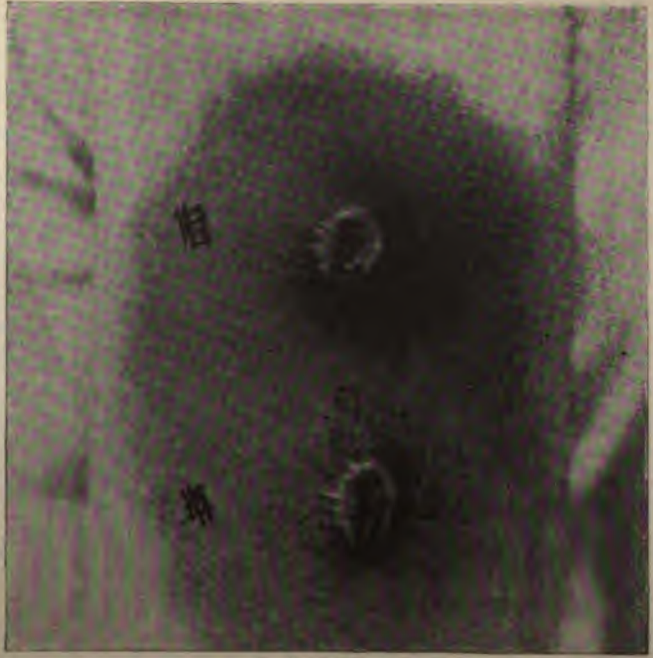

Fig. 164.

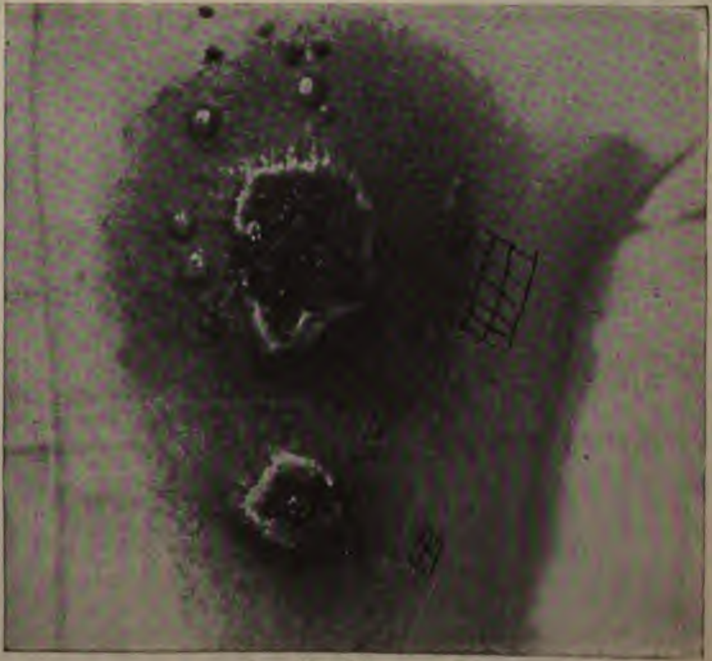

Fig. 165.

VACCINE VESICLES.

Fig. 164 shows typical vaccine vesicles upon the tenth day, life-size, giving also the exact size of the scarification, and an areola of average appearance.

Fig. 165 shows vesicles also upon the tenth day, with the exact size of the scarification, and illustrates the relation between the two. There are several small vesicles near the large one, and an unnecessarily large sore has resulted. Both vesicles were produced with the same lymph. (After photographs by William C. Cutler, M. D.)

or fifth day, is remittent in type, and rises gradually, reaching its highest point with the full development of the vesicle. At this time it varies from 101° to 104° F., falling gradually to normal. The duration of the fever in cases running the usual course is four or five days. Accompanying it there may be anorexia, restlessness, loss of sleep, slight indigestion, and other symptoms of a general indisposition.

Variations in the Course of Vaccinia.—Occasionally the period of incubation is prolonged, and no evidence that the inoculation has been successful is seen for from ten to fourteen days, or even longer, and yet the subsequent course may be normal. In some cases multiple pocks are present, which may be produced by auto-inoculation, usually by scratching. They may be only in the neighbourhood of the original one, or upon any other part of the body. In cases of eczema of the face, inoculation has not infrequently been carried thither. A generalized eruption of pocks is sometimes seen, although this is very rare. In secondary vaccination both the local and general symptoms may be quite as intense as in the primary cases, and in many instances they are even more severe.

Complications and Sequelæ.—Post-vaccine eruptions occur in great variety, and from three quite distinct causes. Even with pure virus there may be urticaria, erythema, or a general roseola which often resembles the eruption of measles, and occasionally purpura has been seen. As the result of mixed infection at the time of the original inoculation, there may be produced impetigo contagiosa, syphilis, or even tuberculosis. From subsequent infection of the vaccination wound, there may be furunculosis, cellulitis, or erysipelas. The complications are in the main the result of the causes just enumerated. In addition to the diseases mentioned, there may be pyæmia, gangrenous dermatitis, suppurative adenitis, and in rare cases pneumonia or nephritis. Sequelæ are very rare; but where latent constitutional tendencies have existed they may be aroused to activity, as in the case of tuberculosis. A child who has once had eczema is liable to a recurrence at such a time; and in very delicate children a condition of malnutrition is frequently intensified if the vaccinia has been particularly severe.

The mortality of vaccination is stated by Voigt, from careful statistics drawn from German sources, to have been 35 in 2,275,000 cases, including both primary and secondary vaccinations. Of the deaths, 19 were due to erysipelas, 8 to gangrene, 2 to cellulitis, 3 to "blood poisoning," and 3 to other causes. It will be observed that these were all, or nearly all, from preventable causes.

Treatment.—The purpose of this is simply cleanliness and protection, to prevent the irritation of clothing, and also to prevent the child from scratching, for by these means the vesicle usually becomes infected. No treatment is required until the vesicle has formed. The limb should then be protected by clean linen, or, better, by a vaccine shield, of which one made of a wire network and fastened to the limb by a tape, is probably the best form. As soon as the vesicle ruptures and begins to discharge serum, it should be frequently dusted with boric acid. If there is suppuration, the pock should be treated antiseptically, like any other granulating wound. If a vaccinated limb is kept perfectly clean, and the pock dry by the free use of the powder mentioned, very little trouble need be apprehended. If the local symptoms are at all severe, the limb should be kept at rest. For this reason, a child old enough to walk should not be vaccinated upon the leg.

The complications are to be treated as when these conditions arise under other circumstances.

CHAPTER VI.

PERTUSSIS.

Synonym: Whooping-cough.

PERTUSSIS is a contagious disease which prevails epidemically and in most large cities endemically. Although it may affect persons of any age, it is generally seen in young children, and as a rule it occurs but once in the same individual. While in later childhood pertussis may be ranked as one of the milder infectious diseases, in infancy it is one of the most fatal. Its principal complications are broncho-pneumonia and convulsions. Pertussis is characterized by catarrhal and nervous symptoms. The catarrh affects the mucous membranes of the respiratory tract, and is probably due to a specific form of infection. It is accompanied by a hyperæsthetic condition of these mucous membranes. The most prominent nervous manifestation is a peculiar spasmodic cough which occurs in paroxysms, and from which the disease takes its name. The cough is no doubt of reflex origin, from an irritation which by different writers has been located in various parts of the respiratory tract. In addition to these conditions, there is present in pertussis a very marked irritability of the nervous system generally, which in infancy frequently shows itself by convulsions.

Etiology.—Pertussis is probably due to a micro-organism, but its nature is as yet unknown. Proximity to a patient is all that is required to communicate the disease, and as in the case of measles even close proximity is not necessary. There seems to be no doubt, from clinical experience, that the disease may be contracted in the open air.

Predisposition.—Fully one half the cases of pertussis occur during the first two years of life. This statement, which is in accord with general experience, is borne out by the following statistics of Szabo (Buda-Pesth), showing the ages at which the disease was met with in 4,591 cases, comprising the records of one clinic for thirty-four years:

Under one year	1,028 cases.	Three to four years	904 cases.
One to two years	1,008 "	Four to seven years	803 "
Two to three years	659 "	Over seven years	189 "

Pertussis thus shows a stronger tendency to affect very young infants than does any other contagious disease. It not infrequently occurs during the first six months of life, a number of cases are on record in which it has occurred during the first month, and one has recently come to my notice where a child twelve days old was attacked, whose mother was suffering from the disease at the time the child was born. Statistics taken from a large number of epidemics show that the disease is nearly twice as frequent in the winter and spring as in the summer and autumn. Epidemics of pertussis often occur at the same time with or follow those of measles.

The susceptibility to pertussis is very great, and is equalled only by that to measles. Biedert reports that of 401 children exposed during an epidemic in a certain village, 366, or ninety-one per cent, took the disease.

Infective period.—Pertussis may be communicated from the very beginning of the catarrhal stage; exactly how long a given case may be contagious it is impossible to say positively. It is pretty certain that it is so during the entire spasmodic stage, and probably longer. In most cases quarantine is required for two months from the beginning of the attack, and in many cases for a much longer time. The usual source of the contagion is the patient, rarely the room or the clothing. While it is possible that pertussis may be carried by a third party, this is very unlikely unless a person has been in very close contact with a patient, and goes at once without change of clothing to another child.

Incubation.—The very gradual onset of pertussis renders it impossible in the majority of cases to fix the exact date, and hence to establish the definite duration of the period of incubation. In cases where it could best be determined it has usually been found to be from seven to fourteen days, or about the same as measles. If, after an exposure, sixteen days pass without the development of a cough, the probabilities are very strong that the disease has not been contracted.

Lesions.—The only constant lesions of pertussis consist in a catarrhal inflammation of varying intensity, which affects the mucous membrane of the larynx, trachea, and bronchi, and sometimes that of the nose and pharynx. If the child dies during a paroxysm, either with or without convulsions, the brain is found intensely congested and may be the seat of punctate hæmorrhages, or even larger extravasations. The lungs always show emphysema if the attack has been severe or protracted. The other pulmonary lesions are due to complications, the most frequent of which is broncho-pneumonia. Catarrhal enteritis and colitis are not infrequent.

Symptoms.—The symptoms of pertussis are usually divided into three stages—the catarrhal, the spasmodic, and the stage of decline.

The catarrhal stage continues on the average for about ten days, although cases show considerable variation on this point. Some children whoop almost from the very beginning of the disease, while others may cough for several weeks before a typical whoop is noticed. The symptoms in the beginning are indistinguishable from those of an ordinary attack of subacute tracheo-bronchitis, and unless there has been an exposure to pertussis no suspicion is excited. After five or six days, however, the cough, instead of abating as in an ordinary cold, gradually increases in severity and occurs in paroxysms. At first these are mild, and there are only two or three a day, but they gradually increase in frequency and severity until the typical whoop is heard which marks the beginning of the spasmodic stage. During the first stage there may be symptoms of a mild grade of catarrhal inflammation of the nose, pharynx, and larynx, and often there is a slight elevation of temperature.

The spasmodic stage.—In a typical paroxysm of average severity the child, who can usually foretell it, will often run for support to the lap of the mother or the nurse, or seize a chair with both hands. There now occurs a series of explosive coughs, from ten to twenty in number, coming in such rapid succession that the child can not get its breath between them; the face becomes of a deep red or purple colour, sometimes almost black; the veins of the face and scalp stand out prominently; the eyes are suffused, and seem almost to start from their sockets; there follows a long-drawn inspiration through the narrowed glottis, producing the crowing sound known as the whoop; and then another succession of rapid coughs follows and another whoop. In a single severe paroxysm, which lasts two or three minutes, the child may whoop half a dozen times; with the final paroxysm a mass of tenacious mucus is usually brought up. The most common attendant symptoms of the paroxysm are vomiting and epistaxis. In a young child vomiting is almost certain to follow, if food has been recently taken. Epistaxis sometimes occurs with nearly every severe paroxysm, but in most cases the bleeding is slight. After such an attack as that described, a child is at times so exhausted as to be hardly able to stand; there is profuse perspiration; his mind is confused, and he may be completely dazed. In infants the attack may result in a degree of asphyxia so deep as to necessitate artificial respiration.

The number of severe paroxysms or "kinks" in twenty-four hours varies, according to the severity of the case, between half a dozen and forty or fifty. There are always many more of a milder form. Paroxysms are often excited by eating or drinking anything which is cold, by a draught of air, or by imitation; they are usually more frequent during the night than the day, and in a close room than in the open air.

In less severe cases no paroxysms of the grade above described may occur, and no typical whoop may be heard throughout the attack; but the paroxysmal nature of the cough which continues until the plug of mucus is raised, the watery eyes, and the vomiting which follows a paroxysm, stamp the disease as pertussis. In young infants the whoop is frequently not marked. The child sometimes coughs until it is asphyxiated, and yet no whoop occurs. The paroxysms are also modified by intercurrent disease, especially by attacks of pneumonia or severe bronchitis. At such times they usually become less frequent and less typical, and may be absent for several days, returning as the complication subsides.

The seat of irritation which produces the cough has been located by different observers in different mucous membranes: some have thought it to be in the nose, others in the trachea, the bronchi, or the larynx. It is very probable that it may not always be in the same mucous membrane; and that the infectious catarrh, which is really the most important element in the disease, may vary in its intensity and location in different cases. The weight of evidence seems to be that in the great majority of cases the source of irritation is in the larynx or trachea. From laryngoscopic examinations made during the disease, Von Herff found the mucous membrane of the larynx to be swollen and congested, and occasionally the seat of small hæmorrhages or superficial ulcers. He states that the frequency and severity of the paroxysms corresponded with the degree of laryngitis, and he found that a paroxysm could always be excited by irritating the mucous membrane between the arytenoid cartilages. During a paroxysm he observed that there was a collection of mucus on the posterior laryngeal wall, the removal of which had the effect of shortening the paroxysm.

Rossbach made laryngoscopic examinations, with negative results so far as the larynx was concerned, but he states that a plug of mucus could always be seen in the lower trachea for one or two minutes before the paroxysm occurred. There is little doubt that this collection of mucus is the exciting cause of the paroxysm, as it is a familiar clinical fact that the paroxysm always continues until this is dislodged.

The average duration of the spasmodic stage is about one month. It increases in intensity for the first two weeks, remains stationary for about a week, and then gradually diminishes in severity. The course and duration are, however, subject to wide variations. In mild cases this stage may last only a week; in severe cases, especially in the winter season, it may continue for three months, at times greatly subsiding, but lighting up again with all its previous severity with every fresh attack of cold. After it has entirely ceased the whoop may return with an attack of bronchitis, and continue for a month or more. This is not to be regarded as a true relapse of pertussis. The habit of the paroxysmal cough once established, it tends to recur with every slight bronchitis, often for months afterward.

The stage of decline.—Gradually the severity of the paroxysm abates, the whoop ceases, and the cough resembles more and more that of ordinary bronchitis. This stage usually continues about three weeks, but may be prolonged indefinitely in the winter months.

Complications.—*Hæmorrhages.*—The hæmorrhages of pertussis are mechanical, and depend upon the intense venous congestion which accompanies the paroxysm. Epistaxis is the most frequent variety, and occurs in a considerable proportion of the severe cases, in a few with almost every severe paroxysm, but it is rarely severe enough to require local treatment. Hæmorrhages from the mouth may have their origin either in the pharynx or the bronchi, the blood being brought up by the cough; such hæmorrhages are usually small. Conjunctival hæmorrhages are less frequent, and are usually slight, although I have seen the entire conjunctiva of one eye covered. In a case under my observation there was bleeding from both ears with every severe paroxysm, for more than a week. This child had previously suffered from scarlatinal otitis, with perforation of the drum membrane. Small extravasations into the cellular tissue beneath the eyes are occasionally seen, giving an appearance somewhat like an ordinary "black eye." Intracranial hæmorrhages are not frequent, but many examples have been recorded, and they may be severe enough to produce death. They are usually meningeal, very rarely cerebral; according to their extent and location they may produce hemiplegia, monoplegia, aphasia, facial paralysis, or disturbances of the special senses of sight, hearing, sensation; in addition, there may be convulsions or rigidity, but rarely complete coma. The extravasations are usually small, and the symptoms which they produce disappear at the end of a few weeks. Fatal cases with autopsies have been reported by Cazin, Marshall, and others. In almost every instance these hæmorrhages have occurred as a direct result of severe paroxysms of the cough. Purpura hæmorrhagica as a sequel of pertussis was twice seen at the New York Infant Asylum.

Respiratory system.—The most serious complications of pertussis are connected with the lungs. By far the largest proportion of deaths is due to pulmonary complications, usually broncho-pneumonia. This is more frequent in winter and spring than in the summer months, and is especially to be dreaded during infancy. In later childhood lobar pneumonia is occasionally seen. Pneumonia rarely begins before the second week of the disease, and most frequently develops at the height or toward the close of the spasmodic stage. The physical signs present no peculiarities; the cough changes somewhat in character during the pneumonia, and the whoop may not be heard. The prognosis of the pneumonia is bad, because of the debilitated condition of the children at the time of its occurrence. A great danger is from the supervention of convulsions, this being a frequent mode of termination. As there is always considerable emphysema the rapidity of breathing is frequently out of proportion to the temperature, which often is only moderately elevated. If the child escapes the dangers of the acute stage, death may still occur from exhaustion, owing to the protracted course which the disease frequently runs.*

Bronchitis of the large tubes is present in almost all the severe cases, and is not of itself serious. Bronchitis of the small tubes has the same dangers and the same complications as broncho-pneumonia.

Vesicular emphysema has been present, I think, in every case which I have seen upon the post-mortem table; a certain amount of it, no doubt, occurs in every severe case. It is produced by the forcible cough of the paroxysm. In very severe cases interstitial emphysema is also found. Northrup has reported a remarkable instance of this complication. Rupture of the air-blebs which form on the surface of the lung, may lead to emphysema of the cellular tissue of the mediastinum, and the air may find its way along the great vessels into the neck, and finally into the subcutaneous cellular tissue of the entire body. Cases of general subcutaneous emphysema have been reported by Croker and Hodge, both of which ended fatally, one in three and one in eight days from the beginning of the emphysema. In the great majority of the cases vesicular emphysema is not permanent.

Digestive system.—During the summer, infants with pertussis are almost certain to suffer from diarrhœa; it may be only an occasional symptom, or the attack may be severe and prolonged, resulting in the development of ileo-colitis. The intestinal complications may be almost as serious in summer as are those of the respiratory tract in winter. Vomiting is even more frequent than diarrhœa, and, while it may be distressing at any age, it is especially so in infancy. So frequently does the taking of food excite vomiting, that the nutrition of these patients often becomes a matter of the greatest difficulty, and in fact the most serious problem in the management of a case. Malnutrition and even marasmus may follow, or the general resistance of the child may become so reduced by lack of food that it falls a ready prey to pneumonia.

Nervous system.—There may be convulsions, coma, paralysis, aphasia, disturbances of sight or hearing, and in rare cases even of the mental condition. The most serious of these complications are convulsions. They are much more frequent in infancy than later, and are particularly so in those who are rachitic, where they are often fatal. Convulsions are of course more common in severe attacks, but they may occur suddenly where there has previously been no cause for anxiety. They are especially to be dreaded if pneumonia is present. The attack of convulsions may be the culmination of the extreme degree of nervous irritability which accompanies the paroxysm, it may be due to asphyxia, or to an intracranial

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* For further particulars regarding the pneumonia of whooping-cough, see page 503.

lesion; if the latter, there is usually meni
be suspected if there are continued con
general rigidity or hemiplegia.

Disturbances of the sight are not infr
these are transient, but there may be
days or even weeks. The transient symp
circulatory changes in the brain during t
last for two or three weeks are probably
Disturbances of hearing are rare. The di
ring with pertussis may likewise be transi
be explained in the same way as the dist
The most common form is hemiplegia.

Albuminuria is not infrequent, being
by Knight. The quantity of albumin is
companied by a few hyaline casts. Both
latory disturbances in the kidney. Other
hernia, prolapsus ani, and ulcer of the fren

Diagnosis.—In the early part of the cat
make a diagnosis; there is no way by wh
guished at that period from an ordinary
gradual increase in severity in spite of tr
cough becomes more and more paroxysmal,
vomiting and suffusion of the eyes, should
tussis. If the disease is prevalent, the diagn
when these symptoms are reached, even wit
which present the greatest difficulty in diag
where, perhaps, without ever having a typi
been exposed to pertussis coughs for a nu
circumstances it may be impossible to say,
whether it was or was not pertussis; but
no physical signs of bronchitis, and has be
probabilities are strong that a severe cough
weeks, and upon which ordinary treatment
tussis.

The diagnosis is difficult also in early in
cough is likely to show more or less of a sp
may be occasionally heard a fairly typical w
nary attack of bronchitis. This is to be co
which occurs with a mild attack of catarrh
also present difficulty in diagnosis. I have
children with pertussis of typical duration a
suffering from a cough, which lasted but t
whoop was heard only for one day. If such
it would be impossible to make a positive di

Irritation of the pneumogastric or recurrent laryngeal nerve from enlarged tracheal or bronchial lymph nodes, whether of a simple or tuberculous character, may give rise to a spasmodic cough, which in certain cases may be indistinguishable from whooping-cough. The prolonged duration of these cases is sometimes the only diagnostic point; but the paroxysms are usually not so severe as in true pertussis, and the course is generally less typical.

Prognosis.—The most important factor in the prognosis of the disease is the age of the patient. After the fourth year it is indeed rare that either a fatal result or serious complications are seen; but during infancy, and particularly during the first year, there are few diseases more to be dreaded. This is especially true on account of the connection of whooping-cough with the three most fatal conditions of infantile life—broncho-pneumonia, diarrhœal diseases, and convulsions. Fully two thirds of the deaths from whooping-cough occur during the first year of life. The prognosis is very much worse in infants of the first three months than in those who are older and consequently have more resistance. It is better in the summer than in the winter, because broncho-pneumonia is then less frequent. It is particularly bad in delicate infants, in those who are rachitic, in those who are prone to attacks of bronchitis, in those who have suffered previously from pneumonia, and in those with a strong tendency to tuberculosis.

The exact mortality of whooping-cough it is difficult to state in figures. During the first year of life it is probably not far from twenty-five per cent, although it diminishes rapidly after this time. In foundling asylums and hospitals for infants it is to be ranked among the most fatal diseases, and in some epidemics the mortality in such institutions is as high as fifty per cent.

Fully two thirds of the deaths during whooping-cough are from broncho-pneumonia; the next most frequent cause is diarrhœal diseases. Convulsions may be the mode of death in either of the above conditions, or may occur apart from them. During the first year, death often results from marasmus, the child having been reduced by the prolonged disease. Occasionally death is due to asphyxia following a severe paroxysm, to intracranial hæmorrhage, or to general emphysema.

As a predisposing cause of tuberculosis, pertussis is second only to measles. In both diseases tuberculosis develops in much the same way and from much the same causes (p 922).

Prophylaxis.—Pertussis is a contagious disease, and a child suffering from it should be isolated from other children wherever this is possible. Children with pertussis should never be allowed to attend school, and needless exposure should always be avoided.

Young infants, delicate children, and those with a predisposition to tuberculosis, should be most carefully protected against exposure, since it

is in them chiefly that the disease is like
the patient that the disease is nearly alway
the same necessity for the fumigation an
after other contagious diseases. In ins
always be practised, and in private houses
be occupied by an infant.

It is as undesirable as it is impossible t
to a single room during the attack; all th
would be dangerous should therefore be se
antine should continue on the average f
modic stage is over.

Treatment.—*General measures.*—It is
dren should have plenty of fresh air th
matter of common observation that they
of doors than in the house, and that the
frequent when children are confined in clo
in the open air as much as possible durin
and even on unpleasant days the windows
child's temperature is above 100° F., he sh
have fresh air in the room. In all cases it
dows freely opened at night, unless bronc
present.

A change of air is desirable for cases
prolonged. A warm place at the seashore
be beneficial. The improvement during a
marked, and it surpasses even a residence a

The rooms occupied by children suffer
frequently changed, thoroughly aired, and
fumigated. This change of rooms, cloth
exerts a marked influence on the course
inference being that continued re-infection
should be made twice a week, and it is of sp
where many children quarantined in a ward

Vomiting and indigestion are both so f
at times very difficult. In most cases it is
a short time, if the first one has been vomite
paroxysm. Children over two years old sho
upon a fluid diet, chiefly of milk. For inf
and in many instances it must also be part
cation which causes disturbance of the sto
severe cases, on account of the inability t
food, the child's strength should be kept
stimulants.

Local treatment.—This may be in the fo into the nose, local applications to the larynx by a spray or swab, and inhalations.

The first two methods have been advocated, in the belief that the cough is due to an infectious catarrh having its seat in the nose or larynx. For insufflation, quinine or benzoic acid is preferred, mixed with some finely divided, inert powder, such as bicarbonate of sodium, talcum, or coffee; these are used with the powder insufflator once or twice daily. Local applications to the larynx may be made by means of the spray or swab. Resorcin and carbolic acid, each in a one-per-cent solution, are most used. These applications are made once or twice daily. I have not seen from any of the above methods the beneficial results claimed, and I believe them to have been exaggerated. The application of cocaine to the larynx, although highly recommended, should never be employed in young children on account of the danger of poisoning.

Inhalations are of much more value. They are useful to modify the catarrh by allaying irritation, facilitating the expulsion of the mucus, and possibly as antiseptics. Those most employed are carbolic acid, creosote, and cresoline. In my experience creosote is by far the best. These substances may be used dropped upon cotton in a respirator, or vapourized over an alcohol lamp (page 58), or cloths may be dipped in solutions and hung in the patient's room. In using carbolic acid the possibility of absorption should not be forgotten, and the urine should be watched. In paroxysms of great severity, inhalation of chloroform may be required as the only means of warding off convulsions or preventing dangerous asphyxia.

Internal medication.—Of the innumerable drugs which have been recommended for this disease, three possess undoubted advantages over all others—viz., quinine, belladonna, and antipyrine. Quinine is best given to young children as an aqueous solution of the bisulphate; it should be given in full doses, from eight to ten grains daily to an infant under two years, and from fifteen to twenty grains to children from two to four years old. The only objection to quinine is its tendency to upset the stomach; if it causes vomiting the dose must be reduced or the drug discontinued. It will usually be found more successful in children over, than in those under, four years. I rarely attempt to use it in infants.

Belladonna may be used in the form of the fluid extract or atropine. It is important to begin with a small dose and gradually increase both its frequency and size until the physiological effects of the drug are produced. To an infant two years old, half a minim of the fluid extract may be given every four hours as an initial dose, gradually increasing to every two hours; if atropine is used, gr. $\frac{1}{400}$ may be given in the same way. Although belladonna usually has a decided influence in reducing both the

frequency and the severity of the paroxysn
symptoms that it is difficult to continue its

Antipyrine has been in my hands more
or belladonna. It may be used with safet
siderably larger doses than are ordinaril
months old the initial dose should be one
this may be given every two hours, and so
For a child two years old the initial dose s
to six hours, gradually increased if necessa
hours. The frequency of the dose will de
case. In the event of the development
should be discontinued.

With bromoform and other newer reme
cess than with those referred to. Nearly
irritability have a certain amount of effect
of pertussis; chloral and trional are often u
are so severe as to prevent sleep. Better r
from a combination of the bromide of sodi
the latter given alone. I do not believe tha
tion or local treatment shortens pertussis;
self-limited, great benefit to the patient res
number and the diminution of the severity

In establishing the value of any meth
remembered that the number of cases in wh
shorter than the average is large, and also th
ment if employed after the attack has reach
beneficial, as the natural tendency is then t
particular line of treatment is to be judge
effect in reducing the number and severity o
to be evident in the case of drugs within tw
be determined by keeping a careful record
oxysms day and night. No drug succeeds e

In a mild case, where the number of s
ceed eight or ten during the day, where ther
eral health is not affected, it is not usual
administration of any drugs throughout th
antipyrine or phenacetine at night may be al
in infants must be watched with great care a
possible dangers which may supervene sud
mild attacks. For severe cases antipyrine sh
frequency and the severity of the paroxysms
used if much catarrh is present. All the
allowed. For older children the same plan o
or quinine or belladonna may be substituted

As these drugs are given solely for the purpose of diminishing the frequency and severity of the paroxysms, their continuous use should be deferred until the symptoms are sufficiently severe to greatly disturb the child, the benefit at this period being more striking than if they are begun early and used continuously.

CHAPTER VII.

MUMPS.

Synonym: Epidemic parotitis.

MUMPS is a contagious disease characterized by swelling of the parotid, and sometimes of the other salivary glands, with constitutional symptoms which are usually mild. Both severe complications and a fatal termination are extremely infrequent. The disease is not a very common one, and general epidemics are rare.

Pathology and Lesions.—The contagious character, definite incubation, and typical course, stamp the disease as a general one due to a specific poison, probably a micro-organism, whose nature is as yet unknown. It is probable that infection takes place through the salivary ducts.

The precise nature of the changes in the gland is still a matter of dispute, as opportunities for pathological examination are very rare. From existing evidence it would appear that the gland substance is first involved, and afterward the surrounding connective tissue. The gland is the seat of an intense hyperæmia and œdema; the walls of the salivary ducts are swollen, and the ducts are obstructed. While the primary disease does not tend to excite suppuration, pyogenic germs may occasionally gain entrance and an abscess form; but this is to be regarded as a rare, accidental infection.

In the great proportion of cases the parotids alone are affected, although the same changes are occasionally found in the other salivary glands. There are no other essential lesions of the disease, those which are found depending upon complications.

Etiology.—Mumps is spread by contagion, close contact being usually required to communicate the disease, although it is known to have been carried by a third party and even by clothing. The susceptibility of children to the poison of mumps is much less than is the case with the other contagious diseases, so that only a small number of those who are exposed take the disease. The greatest predisposition is between the fourth and fourteenth years. Infants are rarely affected, although a case in a child three weeks old is vouched for by so good an observer as Demme.

Mumps is contagious from the beginning of the symptoms. Two cases have come under my notice in which the disease was communicated before any swelling was seen. It is impossible to fix with certainty the duration of the infective period. The disease is undoubtedly communicable for several days after the swelling has subsided; and for safety a case should be isolated for three weeks from the beginning of symptoms, or at least ten days after the swelling has disappeared.

Incubation.—In forty-eight collected cases in which the incubation was definitely determined, it varied between three and twenty-five days. It was less than fourteen days in only four cases, and in twenty-six of the forty-eight cases it was between seventeen and twenty days. In three cases of my own in which it could be definitely fixed, the incubation was nineteen days in one and twenty days in two cases. The average period of incubation, then, may be stated to be from seventeen to twenty days.

Symptoms.—In the milder cases the local symptoms are the first to attract attention; in those which are more severe there are frequently prodromal symptoms of from twelve to forty-eight hours' duration,—anorexia, headache, vomiting, pains in the back and limbs, and fever. Soltmann has reported a case ushered in by convulsions. The initial temperature in a mild attack is 100° to 101° F.; in a severe one, from 102° to 104° F.

Of the local symptoms, the pain usually precedes the swelling; it is increased by movement of the jaws, by pressure, and sometimes by the presence of acid substances in the mouth. It is usually referred to the posterior part of the jaw just below the ear. The swelling may begin simultaneously in both parotids, but more frequently one side is involved a day or two in advance of the other. It usually reaches its maximum on the third day, often on the second, remains stationary for two or three days, and then subsides gradually. The degree of swelling varies with the severity of the attack. When it is marked, the patient presents a ridiculous appearance and is scarcely recognisable; it fills the lateral region of the neck between the jaw and the sterno-mastoid muscle and extends forward upon the face to the zygomatic arch, so that the centre of the tumour is usually the lobe of the ear. The other salivary glands may swell simultaneously with the parotids, or several days later, even after the parotid tumour has disappeared. Occasionally swelling of the submaxillary or the sublingual glands occurs before that of the parotid, and in rare instances these may be the only glands affected.

As a rule, the parotid of both sides is involved. Of 282 cases both sides were affected in 215. When one side alone is involved, it is the left a little more frequently than the right. The interval between the swelling of the two sides may be a week, or even five or six weeks, but usually it is only two or three days.

The salivary secretion is usually very much diminished, and the dry mouth causes great discomfort. An exceptional instance has been reported by Simon, in which a distressing salivation occurred, the secretion amounting to six or eight ounces daily.

Although as a rule the patient is not seriously ill, mumps may in rare cases produce most alarming and even dangerous symptoms. The temperature may for several days reach 104° F. or more, deglutition may be extremely difficult, pressure on the jugular veins may lead to venous hyperæmia of the brain, causing headache and sometimes delirium; there is sometimes great prostration and the symptoms of the typhoid condition. These severe attacks are nearly always in children over twelve years old.

The constitutional symptoms of mumps usually last from three to five days; the swelling continues on an average a little less than a week. If the case has been a severe one, slight swelling may continue for two weeks or even longer. Relapses, in which the opposite side from the one first affected is involved, are quite frequent, occurring in about ten per cent of the cases.

Complications and Sequelæ.—In childhood the complications are few and usually unimportant; but in adolescence they are occasionally serious. Orchitis is exceedingly rare in childhood; of 230 cases observed by Rilliet and Barthez, this was seen in but 10, and only 3 of these cases were under fifteen years, and no case under twelve years old. When orchitis occurs it is generally toward the end of the second or the beginning of the third week; it is usually marked by an accession of fever, sometimes by a chill; if severe, nervous symptoms may be present. The local symptoms do not differ from those of an ordinary attack of orchitis. The body of the testicle and not the epididymis is generally affected. The acute symptoms continue for three or four days, and the entire duration is about a week; although the testicle is often enlarged for some time afterward, and atrophy of the organ may follow.

In females, congestion and swelling of the breasts, ovaries, or labia majora may occur; and, although they are all very rare, most of them have been observed even in young children.

Nephritis has in a few instances followed mumps, sometimes coming on as late as four or five weeks after the attack. Single cases have been reported by Croner, Isham, Henoch, and others. Nervous sequelæ are more frequent, but even these are rare. Jaffrey has reported a case of multiple neuritis with typical symptoms, occurring three weeks after an attack. Facial paralysis three weeks after mumps has been reported by Hellier, apparently due to an extension of inflammation from the gland to the seventh nerve.

Pearce* has collected an interesting series of forty cases of deafness following mumps, in which there was no sign of otitis, the symptoms coming on suddenly with vertigo, a staggering gait, and often with vomiting. In most of the cases the deafness was unilateral and the loss of hearing was permanent. The cause assigned was disease of the auditory nerve, the seat of the trouble being in the labyrinth. Toynbee has reported an instance of hæmorrhage into the labyrinth. Otitis media is rarely seen.

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* Manchester Chronicle, 1885.

Suppuration of the parotid glands occurs in about one per cent of the cases, and is probably due to accidental infection. Gangrene and sloughing of the parotid were observed twice by Demme in 117 cases, both of which proved fatal. Pneumonia, meningitis, endocarditis, and pericarditis have all been observed as complications of mumps, although all are extremely rare.

Prognosis.—In the great proportion of cases mumps is a mild disease, and terminates in complete recovery in a few days. In young children complications are infrequent, and those which occur are rarely severe.

Diagnosis.—Mumps is most likely to be confounded with acute swelling of the cervical lymph nodes. In a parotid swelling, the lobe of the ear is near the centre of the tumour, which extends backward to the sterno-mastoid muscle and forward upon the face as far as the zygomatic arch, embracing the angle and ramus of the jaw.

A swollen lymph node is usually entirely below the ear and behind the jaw, never extending upon the face. The tumour is generally smaller and more circumscribed if only a single node is involved, and it comes on much more slowly than does mumps. When only the submaxillary or sublingual glands are affected, the diagnosis from swollen lymph nodes is sometimes impossible except by the course of the disease. Mumps is characterized by the rapidity with which the swelling occurs, and by its relatively short duration.

Treatment.—The disease is self-limited and the individual symptoms rarely distressing, so that in most cases very little treatment is required. If constitutional symptoms are present the patient should be kept in bed, and if there are none he should be confined to the house. The gland should be protected by cotton or spongio-piline, and if the pain is severe heat should be applied or the gland painted with belladonna. The diet should be liquid, on account of the pain produced by mastication. The mouth should be kept clean by the use of some antiseptic mouth-wash. The general symptoms and complications are to be treated according to the indications in the individual cases. Cases of mumps occurring in schools or institutions should be quarantined for three weeks, and in private practice where there are susceptible persons. Fumigation and disinfection after an attack are unnecessary.

CHAPTER VIII.

DIPHTHERIA.

UNTIL within the last few years it has been customary to class as diphtheria all diseases characterized by the production of a false membrane upon the mucous membranes of the throat or air passages. Bacteriological study of these cases has yielded results so uniform that we are now able to separate them into two groups: In one, there has been demonstrated the constant presence of the Klebs-Loeffler bacillus—the *Bacillus diphtheriæ*; this group includes cases formerly classed as primary diphtheria, and also certain others such as primary membranous laryngitis and rhinitis, the pathology of which has been the subject of much dispute. In the other group the Klebs-Loeffler bacillus is absent; this group includes most of the membranous inflammations of the throat which occur as complications of measles and scarlet fever, and many primary cases of such inflammations affecting only the tonsils or the tonsils and pharynx, and formerly regarded by some as croupous tonsillitis, by others as mild or doubtful diphtheria. The form of bacteria which has usually been found in these inflammations which simulate diphtheria, is the streptococcus pyogenes, occasionally the staphylococcus. In the following pages the term *diphtheria* will be limited to those cases in which the Klebs-Loeffler bacillus is present, the others being grouped under the head of false or *pseudo-diphtheria*.

Diphtheria may then be defined as an acute, specific, communicable disease due to the bacillus of Klebs and Loeffler. It is usually characterized by the formation of a false membrane upon certain mucous membranes, especially those of the tonsils, pharynx, nose, or larynx. Like other pathogenic organisms, however, this germ acts with varying intensity, and may cause inflammation of all degrees of severity, from a mild catarrhal angina to the most serious membranous inflammation; but to all alike the term diphtheria should be applied. In its mild form it may be almost without constitutional symptoms; but in its severe form it is attended by great general prostration, cardiac depression, and anæmia, it is frequently complicated by pneumonia and nephritis, and it may be followed by localized or general paralysis; it then constitutes one of the diseases most to be dreaded in childhood. While, therefore, there are now included under the term diphtheria many cases formerly not recognised as such, there are excluded many others which somewhat resemble it clinically, but in which the bacillus of diphtheria is absent.

Etiology.—*The Bacillus Diphtheriæ.*—This was first described by Klebs in 1883, and during the following year it was isolated by Loeffler and shown to be pathogenic. Little was added to this discovery until 1888, but from that time until 1891 very extensive observations were made in France, Germany, and America,* all confirming the early conclusions of Loeffler. By 1891 all the conditions, says Welch, had been fulfilled to demonstrate that this bacillus was the cause of diphtheria,—viz., (1) its constant presence; (2) its isolation in pure culture; (3) the reproduction of the disease in animals by inoculation with pure cultures; (4) the finding of a similar distribution of the bacilli in the original and in the experimental disease.

The bacillus of diphtheria varies considerably in size and shape even in the same culture. Its length is from 1·5 to 6·5 micro-millimetres; its diameter, from 0·3 to 0·8 micro-millimetres. In a specimen it occurs singly or in pairs, sometimes in chains of three or four; the bacilli may lie parallel, but frequently two form an acute or an obtuse angle (Plate XVIII, 3, 4, and 5). They are straight or slightly curved, and are somewhat swollen or club-shaped at their ends. The bacilli have no spores, but contain highly refractile bodies, which cause them to stain peculiarly. With alkaline methyl blue (Loeffler's stain) they stain in a very characteristic way; not uniformly, but the oval bodies in the central parts or in the extremities of the bacillus, stain more deeply than the rest of the protoplasm. This difference is not seen in the old cultures which stain with difficulty (Park).

The best culture medium is Loeffler's blood-serum.† After ten or twelve hours, at a temperature of about 100° F., the colonies (Plate XVIII, 1 and 2) appear slightly elevated, of a white or grayish colour, with rounded but generally irregular borders. They may increase to one fourth of an inch in size; and although the early colonies are about the same size as those of the streptococcus, the later ones are larger. They do not liquefy the blood-serum.

Distribution and mode of communication.—Diphtheria prevails epidemically, endemically, and sporadically. In most large cities it is endemic, occasional cases occurring throughout the year, with periods in which outbreaks of considerable severity are observed. In the country it prevails chiefly as an epidemic. The disease is often introduced into remote districts in some inexplicable manner, and before its nature is recognised a large number of persons have been exposed, and an epidemic results.‡

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* For a summary of the literature upon this subject see Welch and Abbott, Johns Hopkins Hospital Bulletin, February and March, 1891; Prudden, New York Medical Record, April, 1891; Park, New York Medical Record, July and August, 1892.

† Blood-serum two thirds, nutrient bouillon one third, glucose one per cent.

‡ The following is an example of the way in which diphtheria may be introduced: In the country branch of the New York Infant Asylum, consisting of a somewhat isolated community of about five hundred persons, chiefly children, there had been no

Diphtheria does not arise *de novo*. Every case has its origin in a previous case either directly or remotely. The bacilli may enter the body through the inspired air; they may be taken into their mouth with toys or other articles upon which they have lodged, or by kissing, and sometimes accidental inoculation occurs. As a rule, the bacilli first gain a foothold upon the mucous membrane of the tonsils, nose, or larynx.

Direct infection is the cause in the great majority of the cases. There is no proof that the bacilli are contained in the breath of a person suffering from the disease. They are discharged in great numbers in the saliva and mucus from the mouth and nose, and in pieces of membrane which are coughed up; they are not present in the urine or fæces. The most contagious cases are those of pharyngeal diphtheria of severe type and long duration, chiefly on account of the amount of discharge which accompanies them. The cases that are least contagious, and for precisely opposite reasons, are those in which the membrane is limited to the larynx and lower air passages.

Direct infection may occur from persons convalescent from diphtheria, whose throats still contain virulent bacilli, or from persons suffering from a mild form of the disease, which is not recognised as diphtheria. In the latter way it is often spread in schools. It has been shown that a person may harbour virulent bacilli in his nose or throat, and may even communicate the disease to others, without himself suffering from diphtheria at any time.

The length of time during which a patient with diphtheria may convey the disease to others is somewhat uncertain. Transmission is possible so long as virulent bacilli remain in the throat; these are frequently found two weeks after the membrane has disappeared and the patient is regarded as entirely well, and in a few cases they are found five or six weeks or longer after recovery.

Indirect infection is not uncommon, and may occur from the bed or clothing of the patient, from the carpet, furniture, wall-paper or hangings of the room, from toys or picture-books, from dishes, feeding-bottles, or drinking-cups, from swabs and brushes used for local applications to the throat, from spoons and tongue-depressors, and from surgical instruments with which tracheotomy or intubation has been done. Diphtheria may be carried by a third person, but rarely except by one who has been in close

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case of diphtheria for several years until 1887. The first case was one of membranous laryngitis, proving rapidly fatal in two days. At autopsy, membrane was found only in the larynx. The case was regarded at that time as evidence of the existence of a primary non-diphtheritic membranous croup. In the course of the next few weeks there developed a number of cases of typical diphtheria. On investigation, it was discovered that the nurse who had charge of the child first affected, had been a few weeks before in attendance upon a case of diphtheria. During the five years following, cases of diphtheria occurred in the institution every year.

contact with the patient—either the physician or nurse. The frequency of diphtheria in physicians' families bears witness to the great danger of infection in this manner.

Bacilli may retain their virulence for an indefinite period. Both Park and Loeffler found cultures in blood-serum to be virulent after seven months; Roux and Yersin, bacilli in dried membrane to be virulent after twenty weeks; and Abel, upon a child's toy after five months.

Domestic animals may in rare instances be carriers of infection, and in the case of pigeons, at least, they may themselves suffer from the disease. Diphtheria has been repeatedly spread by milk, but very rarely through the contamination of a water supply. Bad drainage, defective sewerage, and decomposing organic matter are occasionally associated with outbreaks of diphtheria, these furnishing conditions favourable to the development of the bacilli; but apart from the presence of the bacilli they are incapable of producing the disease.

Predisposing causes.—Local conditions in the throat influence very largely the occurrence of diphtheria. An important predisposing cause is the existence of a chronic catarrhal inflammation of the mucous membranes of the nose and throat, so frequently found in children suffering from adenoid growths of the pharynx or enlarged tonsils. These adenoid growths, the tonsillar crypts, and the cavities of carious teeth, may harbour the bacilli for a considerable time both before and after an attack. The condition of these membranes in other acute infectious diseases furnishes a marked predisposition to diphtheria. This is most striking in the case of measles and scarlet fever; it is seen less frequently in typhoid fever and influenza. Children with very sensitive mucous membranes, such as those reared in institutions or in tenement houses, are peculiarly susceptible. Infection through a healthy mucous membrane, if not impossible, is certainly very unlikely.

The two sexes are about equally liable to the disease. Children under ten are much more often affected than those who are older, the greatest susceptibility as regards age being between the second and fifth years. Of 14,688 deaths occurring in New York from diphtheria during ten years, the ages were as follows (Billington):

Under one year	1,214
One to five years	9,622
Five to ten years	3,212
Ten to fifteen years	311
Over fifteen years	329
	14,688

While diphtheria is seen throughout the year, it is rather more frequent during the cold than the warm months. Of 18,688 deaths occurring in New York from diphtheria during thirteen years, there were

10,769 from October to March, inclusive, and 7,919 from April to September, inclusive (Bosworth).

The incubation of diphtheria is short. In most of the cases in which it could be definitely traced it has been between two and five days. It is shorter when the disease is epidemic, when the patient is very susceptible, when the local conditions in the mucous membranes are favourable, and when the type is virulent. The virulence varies much in different cases and in different seasons, and while it is frequently true that persons infected from a mild case have a mild type of the disease, and those infected from a malignant one a severe type, there is no certainty that such will be the sequence. Dr. W. H. Park informs me that, out of many hundreds tested in the laboratory of the New York Health Department, by far the most virulent type of the bacillus was obtained from the throat of a boy who had what was clinically regarded as a very mild form of tonsillar diphtheria.

Second attacks of diphtheria, while more frequent than those of measles or scarlet fever, are relatively rare. It seems to be established by recent observations that the immunity conferred by one attack of diphtheria is of comparatively short duration, amounting probably to a few months only. In my own experience, however, I can recall but very few instances of second attacks. R. W. Parker (London) believes the protection afforded by one attack to be quite as complete as that of measles or scarlet fever.

Lesions.—The essential lesions of diphtheria consist not in the production of a membrane, but, as long ago pointed out by Oertel, and more recently by Babes, Sidney Martin, and others, in certain acute degenerative changes in the cells of the body caused by the diphtheria toxines. These changes are seen particularly in the epithelial cells of the affected mucous membranes, the heart muscle, the kidney, the liver, the peripheral nervous system, the spleen, and the lymph glands; the most characteristic being those of the nerves and the liver. There are other lesions which are the result of the action of other organisms, especially the streptococcus pyogenes and the pneumococcus, either alone, together, or in conjunction with the diphtheria bacillus. The most important lesions due to these organisms are broncho-pneumonia and nephritis; but there may be found in the blood, and in many of the organs of the body, the evidences of the invasion of these bacteria—i. e., a streptococcus septicæmia, less frequently a general pneumococcus infection.

Distribution of the diphtheria bacillus in the body.—Unlike many other pathogenic organisms, the diphtheria bacillus is not widely distributed throughout the body. It is found in great numbers on the surface of the affected mucous membranes and in the false membrane itself, particularly in its superficial portion, but it does not invade deeply the subjacent structures. It is only exceptionally found in the blood and in distant organs, and then in such small numbers that its presence is rarely discovered except by cultures.

The diphtheria toxines.—The wide-spread effects seen in diphtheria are due to the action of certain substances called *toxines* which the diphtheria bacillus produces during its growth on mucous membranes. The toxines have been studied especially by Roux and Yersin, Brieger and Fraenkel, and have been called tox-albumins. They are very diffusible, readily entering the lymphatic circulation and the blood, and through these channels may affect the entire body. It has been shown by Welch and Flexner and others that in susceptible animals there may be produced by the injection of the toxines all the characteristic lesions of diphtheria except the membrane, as well as the essential symptoms of the disease, even including paralysis. For the production of the membrane living bacilli are required.

"*Catarrhal*" *diphtheria.*—It has been already stated that a membrane is not always present in inflammations excited by the diphtheria bacillus. The routine practice of making cultures from diseased throats has established the fact that in a large number of cases catarrhal inflammation may be the only result of diphtheritic infection. To the naked eye there may be only the ordinary changes of a catarrhal inflammation of a mucous membrane; but even in such cases Oertel found the characteristic degenerative changes in the epithelial cells. These, of course, vary in degree with the severity of the process.

The diphtheritic membrane.—The membrane is most frequently seen upon the mucous membrane of the tonsils, soft palate, uvula, pharynx, nose, larynx, trachea, and bronchi; less frequently upon the mouth, lips, œsophagus, conjunctivæ, middle ear, stomach, and genital organs. It may also affect fresh wounds, notably a tracheotomy wound, or any abraded cutaneous surface. The gross appearance of the membrane varies greatly (Plate XVII). It is most frequently of a gray or mouse-colour, but it may be pearly white, yellow, green, and sometimes almost black. It is composed of fibrin, cells, granular matter, and bacteria. Its consistency varies with the relative proportions of the different elements. When made up chiefly of fibrin it is firm and retains its form, often being discharged as a complete cast of the nose, larynx, or trachea. When the amount of fibrin is small the membrane is soft, friable, and sometimes granular. It is more closely adherent upon the mucous membranes covered with squamous epithelium, as in the pharynx and upper air passages, than upon those covered with columnar and ciliated epithelium, as in the lower air passages.

The microscopical examination shows the fibrin to be sometimes granular, but usually in the form of a network, inclosing in its meshes small round cells and epithelial cells in various stages of degeneration. On the surface and in the superficial layer there is usually found quite a variety of bacteria including diphtheria bacilli. Beneath this is a cellular layer containing little or no fibrin, in which also the diphtheria bacilli are usually found. In the deepest parts of the false membrane and in the mucous membrane itself they are few in number or absent.

Characteristic changes which are similar in all the affected mucous membranes are found in the epithelial cells. The cells undergo marked proliferation and infiltration with leucocytes; they show also degenerative changes in their protoplasm and fragmentation of their nuclei, which result in the formation of granular masses of necrotic substance. The infiltration with small round cells is variable in degree in the different mucous membranes; in some it extends deeply into the submucous and even the muscular layers, while in others it is very superficial. Marked evidences of cell death are seen also in the cells infiltrating the deeper layers. In places the epithelium is detached, in others the line between the false membrane and the granular mucous membrane is scarcely distinguishable.

The seat and the distribution of the membrane.—This varies somewhat with the age of the patient, the season, and the peculiarity of the epidemic. In the following table are given some figures from the records of the New York Infant Asylum. These cases were taken consecutively, and did not belong to a single epidemic:

Above the larynx (63 cases).	Tonsils only	27 cases.
	Pharynx or pharynx and tonsils	18 "
	Pharynx and nose or rhino-pharynx	18 "
Not above the larynx (10 cases).	Larynx only	6 "
	Larynx and trachea	1 case.
	Larynx, trachea, and large bronchi	1 "
	Larynx, trachea, large and to smallest bronchi	2 cases.
Both above and below the larynx (36 cases).	Pharynx and larynx	12 "
	Pharynx, larynx, and trachea	6 "
	Pharynx, larynx, trachea, and large bronchi	4 "
	Pharynx, larynx, trachea, large and to smallest bronchi.	10 "
	Nose, pharynx, larynx, and trachea	1 case.
	Nose, larynx, and trachea	1 "
	Pharynx and trachea (none in larynx)	1 "
	Pharynx, trachea, and bronchi (none in larynx)	1 "
		109 cases.

All these cases were in young children, 80 per cent of them being under two years old. In the first group the mortality was 30 per cent; in the second group, 90 per cent; in the third group, 92 per cent. The larynx was involved in 42·2 per cent of the cases. The location of the membrane was determined by autopsies in all the sixty-one fatal cases. The strong tendency of the disease in young children to invade the lower air passages, and to extend far into the bronchi when once the larynx is involved, is also shown in a report upon eighty-seven autopsies in laryngeal cases made by

Northrup. In only three was the larynx alone the seat of membrane; in 57 per cent the membrane descended into the bronchi, and in 37 per cent, to the finest bronchi. All these records are of the pre-antitoxine days.

An interesting comparison with the figures above given may be made with those of Lennox Brown of 1,000 cases, including persons of all ages, but mainly, doubtless, children :

Above the larynx (841, or 84·1 per cent).	Fauces (including tonsils) alone	672 cases.
	Nose alone	2 "
	Fauces and nose	165 "
	Mouth or lips alone	1 case.
	Hard palate alone	1 "
Involving the larynx * (159, or 15·9 per cent).	Larynx alone	4 cases.
	Larynx and fauces	109 "
	Larynx, fauces, and nose	46 "

The tonsils are the most frequent and usually the earliest seat of the diphtheritic membrane; it may form here a tough, leathery patch, partially or completely covering and very adherent to them ; or the disease may affect only the tonsillar crypts, so that the gross lesion may resemble that of ordinary follicular tonsillitis. There is in most cases only moderate swelling, but it may be so great that the tonsils are in contact. The surrounding cellular tissue is infiltrated with inflammatory products.

The membrane covering the pharynx and uvula is also usually very adherent and intimately blended with the mucous membrane. The uvula is swollen and œdematous. Membrane may be seen only upon the fauces and uvula, or the posterior and lateral pharyngeal walls may be covered down to the level of the cricoid cartilage, but generally not below this point. If the posterior pharyngeal wall is covered, the membrane is apt to extend into the rhino-pharynx, and may fill the entire pharyngeal vault, covering the posterior portion of the velum and extending into the posterior nares. The adenoid tissue of the vault is a favourite seat, and is frequently the part most affected. The amount of infiltration of the submucous tissue varies much in the different cases.

The nose may be involved secondarily to the rhino-pharynx, or infection may be through the anterior nares; if the latter, it is not infrequently the only part involved. Many cases classed as nasal are really rhino-pharyngeal. The membrane in the pure nasal cases is usually thick and tough and often separates *en masse*. Both sides are generally involved, but it may be unilateral. Catarrhal diphtheria of the nose and rhino-pharynx is probably more frequent than in any other location.

The epiglottis is swollen to three or four times its normal thickness, and the aryteno-epiglottic folds are œdematous. The anterior surface of the epiglottis is rarely covered by membrane; but its lateral borders and posterior surface, and the aryteno-epiglottic folds are involved in most of the severe pharyngeal cases (Plate XVII, C). This lesion is associated with pharyngeal rather than with laryngeal diphtheria.

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* These being clinical and not pathological records, the number in which the disease extended below the larynx is not given.

The lesions which extend most deeply are thus seen in the tonsils, uvula, pharynx, and epiglottis. But even here there is very rarely deep or extensive sloughing.

The lesions of the larynx, trachea, and bronchi are similar to the above, although much more superficial. The interior of the larynx may be completely covered, the membrane coating the true and false vocal cords and lining the ventricles of the larynx; or it may extend from the epiglottis down to the anterior surface of the larynx, while the posterior surface is free. The membrane in the larynx is not usually very adherent, and it frequently separates and is coughed up in large pieces or even as a cast. The membrane covering the epiglottis and the aryteno-epiglottic folds is very adherent, like that of the pharynx. Catarrhal laryngitis is not an uncommon complication of pharyngeal diphtheria.

In a considerable number of cases the membrane stops abruptly at the lower border of the larynx. In the trachea it is generally loosely attached, and often it is found at autopsy entirely separated from the mucous membrane. It is almost invariably associated with membrane in the larynx. Usually the membrane in the bronchi is continuous with that in the trachea. Occasionally I have seen the trachea and larger bronchi passed over and found membrane only in the larynx and smaller bronchi. As a rule, the bronchi of both sides are affected, and to the same degree. I once saw a case of laryngeal diphtheria in which membrane was found only in the bronchi of one lung. The above exceptions are to be explained as accidents in the mechanical transportation of bacilli.

The extent of the membrane varies greatly in different cases. It may stop at the bifurcation of the trachea or at the bifurcation of the primary bronchi; but if it goes beyond this point it is likely to extend to the minutest subdivisions. In the large bronchi, as in the trachea, the membrane is loosely attached. In the smallest bronchi it is more adherent, and sometimes only to be made out by the microscope. Exceptionally a very tough fibrinous membrane forms in the trachea and bronchi, of sufficient thickness and consistency to be expelled as a cast, reproducing almost the entire bronchial tree.

The inflammation of the mucous membrane of the larynx, trachea, and bronchi is very much less severe and more superficial in character than that of the pharynx, tonsils, and upper air passages.

The buccal cavity is seldom covered by the membrane, and then only in the worst cases of pharyngeal disease; it may line the cheeks, cover the lips, gums, and more or less of the hard palate, but rarely the tongue. It

usually occurs in patches rather than as
recent case I saw the membrane on the lo
though the buccal cavity was free. Only
in diphtheria extend from the pharynx in
ingly infrequent. The membrane is very
in no case, so far as I am aware, has the d
confirmed by cultures. I have in several
stomach; cultures, however, showed strept

The middle ear is not very often invol
direct extension of the membrane from
Eustachian tube. It may lead to very exte
membrane of the tympanum, and often t
of the conjunctivæ is also rare, and is pro
tion rather than to extension from the nos

Diphtheria may attack an abraded cut
inoculation, or it may involve a fresh wo
seen in the wound in the neck from trach
cases in which diphtheria is stated to have
the female genitals, the prepuce, or recen
we had the means of separating by culture
A very considerable proportion of these c
ter group.

Visceral lesions.—The visceral lesions
the action of the diphtheria toxines and
body with other organisms, especially the
mental diphtheria that we owe our most ac
changes, for in human diphtheria the lar
cases show evidences of so-called "mixed i
autopsies upon cases in which the diphth
during life, Reiche* reports that both the
lococcus were found by culture in the kid
and in 45·2 per cent the streptococcus alon
in the kidney in some cases dying very ea
of the disease.

The visceral lesions of diphtheria consi
death similar to those which have already
the epithelial cells of affected mucous mem
rhages due to changes in the blood-vessels
The lesions are found in the lymph node
lium of the kidney, liver cells, peripheral n
The lymph nodes of the cervical regi

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* Centralblatt für innere Medicin, 1895, No. 3.
the Association of American Physicians, 1895.

the most seriously affected. Similar but less marked changes are seen in the tracheo-bronchial and the mesenteric groups, and in the lymph nodules of the mucous membrane of the stomach and intestine. There are degenerative changes in the cells of the nodes most affected, with marked infiltration with leucocytes and frequently small hæmorrhages. The cellular tissue in the neighbourhood of the cervical nodes is often extensively infiltrated with cells. The process in the lymph nodes usually terminates in resolution, rarely in suppuration.

The changes in the spleen are quite constant. The organ is swollen, sometimes very much so, and deeply congested. Hæmorrhages are often seen beneath the capsule; the spleen pulp is soft, the follicles are large, and cell degeneration is quite constantly observed similar to that which takes place in the lymph nodes.

There are frequently small hæmorrhages beneath the capsule of the liver, and sometimes these are seen throughout the organ. There are found scattered through the liver, areas of necrotic hepatic cells which are peculiar to this disease; some of these areas are infiltrated with leucocytes.

The kidneys are involved in almost all fatal cases except where death occurs early from laryngeal stenosis, also in nearly every severe case which terminates in recovery. There is in the milder cases only acute degeneration of the epithelium of the tubes and the tufts, which is the result of the action of the diphtheria toxines; or in the more severe forms there may be acute exudative or even acute diffuse nephritis, the latter usually coming on at a later period of the disease. In the production of these two forms of inflammation, infection with streptococci probably plays the principal part. Welch states that hyaline changes in the glomerular capillaries and small arteries are characteristic features of the nephritis of diphtheria.

In cases dying suddenly in the early stage of the disease, cardiac thrombi are occasionally found. These may be formed rapidly only a short time before death, or slowly during several days when the circulation is very feeble. Portions of these thrombi may be carried into the pulmonary or systemic circulation, causing embolism in any of the arteries of the extremities, the lungs, or other viscera. Even in the early fatal cases the heart muscle may be seriously affected; in the later ones this is almost constant. The changes consist in a toxic myocarditis, the left ventricle being most involved.

Degeneration of the arteries, especially of the endothelial layer, is occasionally seen, and there may be infiltration of the adventitia. The arteries of any of the viscera may be the seat of hyaline degeneration.

The lesions of the brain are very slight and inconstant. In the spinal cord there have been found multiple hæmorrhages into the membranes, and certain degenerative changes in the ganglion cells in the anterior horns, to which great significance was formerly attached, as they were

thought to be the explanation of post-di
changes are, however, slight in comparison
found in the spinal nerves, with which tl
That diphtheritic paralysis is due not to the c
neuritis was first shown by Westphal in 187
during the following year. Degenerative ch
not only in the spinal nerves but also in the
motor-oculi, pneumogastric, and even in the
ing to Sidney Martin* these nerve degen
characteristic lesion of diphtheria. (See c
page 785.)

In infants and young children broncho-pr
it is safe to say, in at least three fourths of
portion of these it is the cause of death. It
of diphtheritic bronchitis of the finer tubes,
the membrane has extended to the bifurcati
important factor in the production of pneun
teria, chiefly streptococci, from the upper ai
always present in the throat, and find in dipht
able to their development. The pneumonia
to be due to auto-infection rather than to o
Northrup found streptococci almost const
monia of diphtheria, often in pure culture.
the streptococcus has been found alone or
coccus or with the diphtheria bacillus, or wit

Where there has been laryngeal stenosis, s
present, and usually it is of the vesicular
tracted cases of stenosis there may be inter
of some of these blebs may lead to the escape
of the mediastinum or of the neck, which ma
a general emphysema of the subcutaneous cel

Blood.—According to the recent studies o
and others, there is found in all severe cases of
number of red cells to the extent of 500,000
assumed to be normal). There is a nearly pr
hæmoglobin, this amounting to from twelv
While the hæmoglobin falls coincidently wi
it is regained much more slowly. Leucocyt
of thirty cases studied by Morse, and in forty-
It is said to be generally proportionate to the
occasionally wanting in the most severe as
mildest cases. The increase in the leucocytes

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* British Medical Journal, Aug

Symptoms.—The clinical picture of diphtheria is one which presents wide variations, depending upon the principal location of the disease, its severity, and its complications. For practical purposes the following seems the simplest grouping that can be made:

1. The mild cases, in which there is either no membrane, or the amount of membrane is small and limited to the tonsils or to the nose, with few or none of the constitutional symptoms which follow absorption of the diphtheria poison. These cases partake essentially of the character of a local disease.

2. The severe cases, which are of two kinds: first, those in which there are marked evidences of constitutional poisoning from diphtheria toxines; and, secondly, those with laryngeal stenosis. The first form is usually accompanied by an extensive formation of membrane in the pharynx and sometimes in the nose. The larynx may be involved secondarily to disease in the pharynx or nose, or it may be primarily affected.

3. The cases of mixed infection or the septic cases. In very many of the cases of the two preceding groups streptococci are found in the throat, but they are not in sufficient numbers or of sufficient virulence to modify the course of the disease. In the cases to which the term mixed infection is applied, in addition to the constitutional symptoms of diphtheritic toxæmia and the local conditions which usually attend it, there are marked evidences of a general septicæmia, usually due to the streptococcus. In these cases the symptoms of inflammation are especially prominent, not only in the pharynx but sometimes in the lymph glands and cellular tissue of the neck, which may be followed by suppuration or sloughing. This form is frequently complicated by broncho-pneumonia even without laryngeal disease, and sometimes by severe nephritis.

Cases without membrane.—During an epidemic of diphtheria in a family or an institution, cases are frequently seen which present the clinical evidences of only a catarrhal inflammation of the nose or pharynx, and yet cultures show the presence of the diphtheria bacillus. These bacilli have been found by Koplik, Park, and others to be virulent in very many of the cases tested, but not in all. Such cases are susceptible of two explanations: first, that they are examples of simple catarrhal inflammation due to other causes, such as cocci, the diphtheria bacillus although present not being the active cause of the inflammation,—in other words, they are cases of simple catarrhal inflammation with the accidental presence of the diphtheria bacillus; the second is, that they are cases of "catarrhal diphtheria," or an inflammation caused by infection with the diphtheria bacillus, but not of sufficient intensity to lead to the production of a membrane. The latter is the view of pathologists, and the one to which clinicians must, it seems, inevitably come. However, a membrane has so long been regarded as a *sine qua non* of this disease that the existence of diphtheria without it, is something which the clinician finds it hard to grasp.

Cases of the kind mentioned may be either pharyngeal or nasal. In the pharyngeal cases there are present the usual appearances belonging to a catarrhal inflammation of moderate severity, often accompanied by swelling and tenderness of the cervical lymph glands. In the cases classed as nasal the usual seat of the pathological process in children is the rhinopharynx. There is a persistent and usually abundant nasal discharge, which is thin, irritating, and occasionally streaked with blood, and which may continue for weeks. In most of these cases constitutional symptoms are absent; in a few there may be a very slight rise of temperature. The clinical evidence that these are cases of diphtheria is, first, that they may infect others; and, secondly, that they may be followed by the sudden development of the symptoms of laryngeal diphtheria. However, nothing but a bacteriological examination is conclusive. The mildness of these cases may be due to the fact that the bacilli are only slightly virulent, that their number is small, or that the resistance of the patient is great. Catarrhal diphtheria is not in itself serious, but it may be followed, particularly in young children, by laryngeal diphtheria and stenosis, or, after it has existed for a time, pharyngeal diphtheria may develop in its usual form. Cases like those just described are to be distinguished from others in which bacilli, either of the virulent or the non-virulent variety, are found without any evidence of inflammation.

Cases with a small amount of membrane.—Tonsillar diphtheria.—The exudation is usually limited to the tonsils (Plate XVII A), and may partake of the character of either follicular or croupous tonsillitis; sometimes there is a slight extension to the faucial pillars or to the pharynx. These cases are quite common, and in some epidemics most of those seen are of this variety. They are more frequent in older children and adults than in infants and young children.

The onset is accompanied by a little soreness of the throat; the initial temperature is from 100° to 103° F.; but the symptoms are often not severe enough to keep the patient in bed. If seen early, the throat shows slight redness, followed by a gray film, and later by a gray or white deposit upon the tonsils. It may start as a small patch which enlarges, or as small, isolated spots which coalesce or remain separate. Until it disappears the membrane generally remains of its original colour. It is generally quite adherent, and can not easily be removed with a swab; usually it is sharply defined, but with a somewhat irregular outline. In many cases the patch is not larger than the finger nail. The inflammatory changes in the pharynx are slight; a faint red areola is frequently present at the border of the patch. The lymph glands behind the jaw are slightly swollen or may be normal. There is no nasal discharge and very little increase in the saliva or mucus from the pharynx. The constitutional symptoms are slight, sometimes almost absent. The temperature commonly continues above the normal while the membrane lasts, its usual range being from 100° to 102° F. The membrane remains from three to ten days,—a shorter time if antitoxine is used. It is very often a matter of surprise that so small an exudate is so persistent. The urine is generally normal. The parents are loath to believe that strict quarantine is necessary in so mild an illness; and where the membrane is only upon the tonsils, even after the disease has run its course, the physician may be led to doubt the diagnosis of diphtheria.

The points which characterize this form of the disease are: the prevalence of diphtheria in the house or in the neighbourhood, a lower temperature than is usual in simple tonsillitis, the absence of marked inflammatory signs in the throat, the adherence of the membrane, its duration, and its white, fibrinous appearance. In most cases one with experience can usually make an accurate diagnosis from the clinical symptoms; but there are others in which the diagnosis from ordinary tonsillitis is impossible, even by the most practised observers, except by bacteriological examination. When diphtheria bacilli are found in these mild cases the question often arises whether they may not be the non-virulent form. Park tested forty such cases, and found the bacilli to be virulent in thirty-five and non-virulent in five. In twenty of the forty cases the clinical diagnosis was follicular tonsillitis.*

These experiments of Park, corroborated by many other observers, show how great is the error of regarding lightly the possibility of infection from mild cases.

Unless the larynx is involved—a not very infrequent occurrence in young children—cases in which the amount of membrane is small almost invariably recover. Occasionally even such mild diphtheria is followed by post-diphtheritic paralysis, but usually affecting the throat only.

Severe cases.—The onset may be gradual, even insidious. There is then a slight indisposition for a day or two, and perhaps some soreness of the throat; the temperature, however, is but little elevated, often less than 100° F. The symptoms may steadily increase in intensity for four or five days, until the maximum is reached. At other times the disease begins abruptly with vomiting, headache, chilly sensations, and a temperature of 103° or 104° F. Occasionally, the first thing to attract attention is the swelling of the cervical lymph glands, which may be so great that mumps is suspected. The abrupt onset is more often seen in young children than in those who are older.

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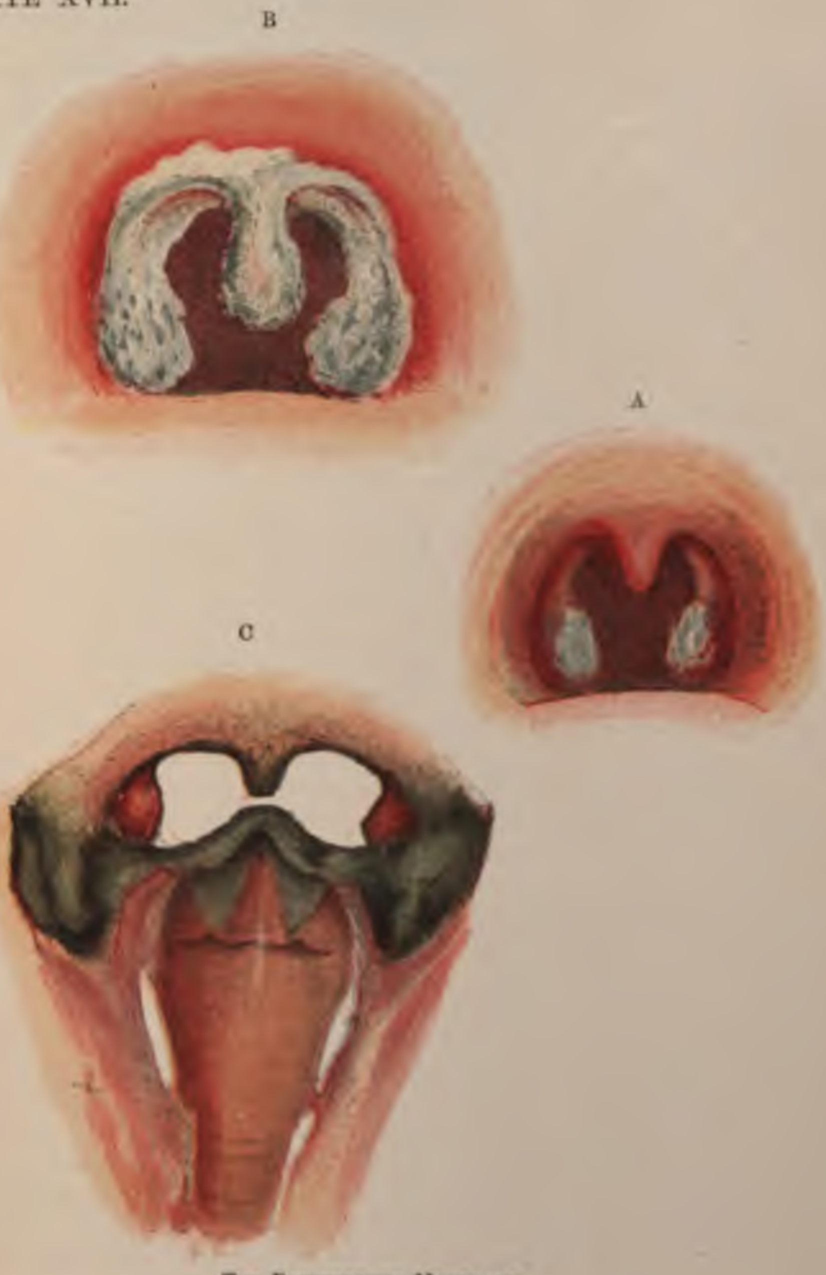
* From one of these mild cases was obtained a bacillus whose virulence so greatly exceeded that obtained from any other case of diphtheria, that its cultures were used for the preparation of toxines for injecting horses. It was by means of these powerful toxines that the strongest antitoxine was produced. The toxines from this bacillus are now used in half a dozen of the principal laboratories of this country where antitoxine is prepared.

The membrane upon the tonsils resemb
viously described, but, instead of remaining
spreads to the fauces, the lateral wall of
rhino-pharynx, and into the posterior nares.
membrane extends is in direct proportion
In some it may cover all the parts mention
its first appearance; in others this may req
the nose is first affected there is an abun
mucus, occasionally tinged with blood, whi
before any membrane is visible. Such cases
slowly, and no membrane may be seen in the

When a severe case is fully developed
charge of mucus from the mouth and nose.
cial ring, and the pharynx are covered with
which is at first gray and gradually becomes
olive-green colour. Membrane is sometime
patches in the mouth. There is obstruction
swelling of the palate, tonsils, and the tissue
mouth is half open, the breathing noisy, the
fissured and bleed readily. Occasionally lar
which may necessitate plugging the nares.
blocked by the swelling and the false membra
the upper lip, and frequently has a fetid odou
there is often regurgitation of fluids through
of the palate. The lymph glands at the an
in severe cases they are very prominent, and
infiltration of the cellular tissue about them,
acteristic of the cases of mixed infection. T
cause of much discomfort, especially the copi
the nasal obstruction.

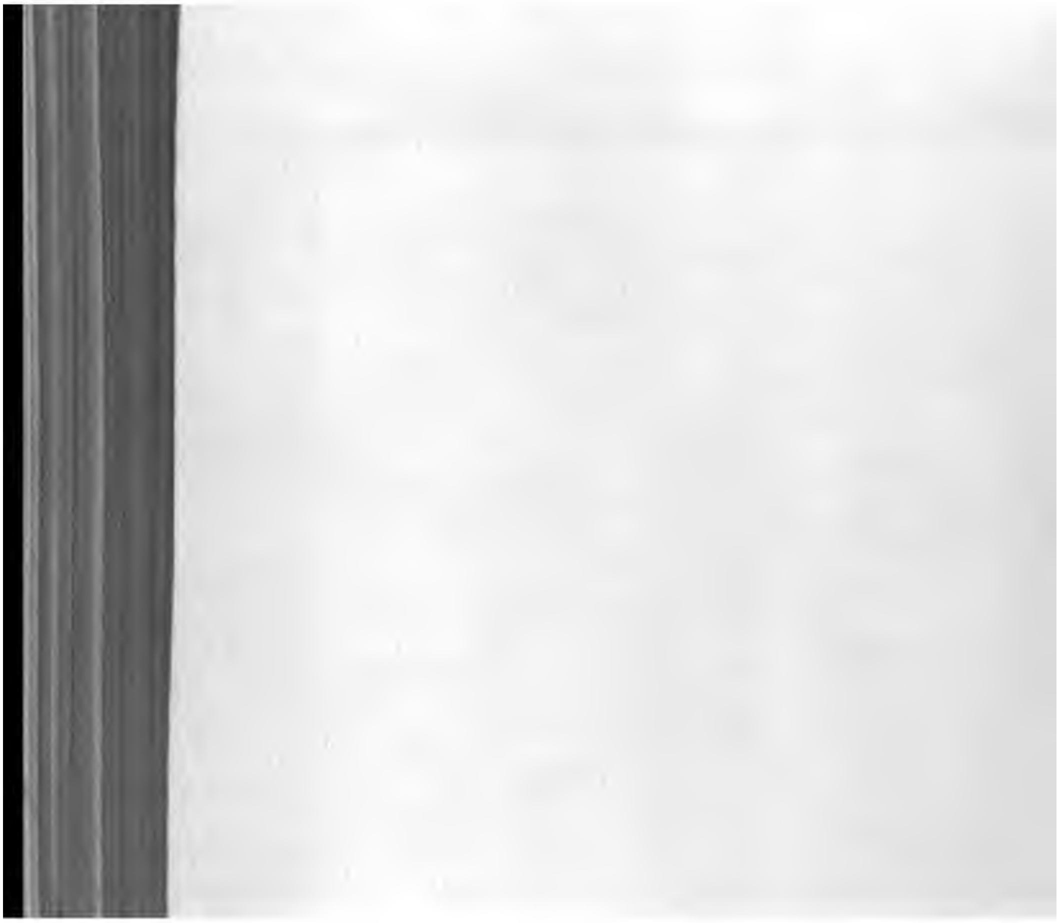
The constitutional symptoms usually incre
sion of the membrane. In the most severe case
with the poison, and all the evidences of inte
the second or third day of the disease. This
weakness and prostration, by a feeble, rapid
complete apathy or stupor, sometimes alterna
It is more frequent for the constitutional sym
and not to reach their height before the fifth
becomes rapid, weak, and compressible, someti
a great and steadily increasing anæmia. The
irregular, and bears no constant relation to the
toms. Its usual range is from 101° to 103°,
cases it may never go above 101° F. It fluc
development of complications, and sometime

PLATE XVII.



The Diphtheritic Membrane.

A. Typical tonsillar diphtheria.
B. Severe pharyngeal diphtheria (fatal case).
C. Pseudo-diphtheria. The specimen is seen from behind, the larynx and trachea having been laid open, and shows an extensive membrane involving the epiglottis and the entire lower pharynx, but extending into the larynx only a short distance. It is also seen upon the posterior surface of the uvula and soft palate, the tonsils being only partially covered. The colour of the membrane is not characteristic of pseudo-diphtheria, as the same appearance is often seen in true diphtheria, particularly of the septic type.



By the second or third day the urine regularly shows the presence of albumin, and by the end of the first week the quantity is often large. Granular and hyaline casts, and occasionally blood in small quantities, are also found. The amount of urine secreted is not noticeably diminished, and dropsy is rare. There is complete anorexia, and often vomiting and diarrhœa are present; in some of the cases they are prominent. Nervous symptoms are seen in all the very severe cases. There may be dulness and complete indifference to surroundings, but more frequently, owing to the discomfort arising from local symptoms, there is extreme restlessness and excitement, sometimes followed by delirium.

At any time during the first week, but not often after that time, symptoms may arise indicating that the disease has extended to the larynx. The first signs of laryngeal invasion usually appear from the second to the fifth day of the disease. There are at first hoarseness, a croupy cough, and slight dyspnœa. In the severe cases these symptoms steadily increase until all the signs of laryngeal stenosis are present. The symptoms of diphtheria of the larynx, whether it begins there or follows disease of the pharynx, have already been described in the chapter on Diseases of the Larynx (page 446). The severe symptoms are due to membrane in the larynx; the milder ones may arise from catarrhal laryngitis.

The local process in the pharynx seems to be a self-limited one. By the fifth or sixth day it has usually reached its height, and after that the appearances do not change essentially for two or three days. From the seventh to the tenth day, in favourable cases, the diphtheritic membrane begins to loosen and separate from its attachment. It hangs loosely from the palate or uvula, and can often be pulled away in large masses. The detachment is frequently rapid, and in two or three days from the time when the first improvement is seen, the tonsils and pharynx may be almost free from membrane. The mucous surface left behind is of a bright-red colour and bleeds easily. The separation of the membrane in the nose and rhino-pharynx takes place more slowly. From the former it may disintegrate gradually or come away *en masse*. With the disappearance of the membrane the local symptoms abate rapidly,—the discharge ceases, the swelling of the lymph glands subsides, deglutition becomes easy and natural, and nasal breathing is re-established. Simultaneously with these changes in the throat the constitutional symptoms improve, but much more slowly. Convalescence is often protracted. The anæmia and muscular weakness, and, most of all, the feeble heart action, may persist for weeks. The more severe the local disease has been, the slower is recovery.

Instead of the usual course just described, the diphtheritic membrane may persist for two or even three weeks. In rare cases relapses occur, the membrane forming again after it has entirely or partially disappeared.

The early course of the disease in the fatal cases often does not differ

from that of the severe cases which end in
nant form, which kills in twenty-four or
after all, is rare. Death most frequently oc
process in the throat, usually from the fifth
due to progressive asthenia the result of di
being characterized by steadily increasing pr
irregular pulse, vomiting, refusal to take fo
apathy or stupor. Death is frequently du
be quite sudden and occur early or late. In
complications, particularly broncho-pneumon
orrhages, and in still others to invasion of th

Even after the throat has cleared off co
fatally from the occurrence of late pneumoni
heart paralysis. Cases of the variety last m
tressing ones, and not infrequent. It often h
garded as convalescent, and the great vigila
weeks has been relaxed. The physician has
looks in only once a day to satisfy himself th
and all congratulate themselves that the da
carefully watched, it is one day discovered th
and occasionally there is slight irregularity.
be more rapid than normal. On inquiry, it i
not take his food so well, that he has refused
vomited once or twice. Slight dyspnœa is
than usual. Sometimes, within twenty-four
such symptoms, the patient is dead. The c
very rapidly. The pulse becomes weaker, mor
slow, but very rapid on slight exertion, and t
cordial weakness or distress. There are dysp
iety, and great restlessness, but the mind is
food or stimulants are taken. The extremi
shows feeble and indistinct heart sounds, but
extreme. Death results from sudden syncop
tempt to administer food, sometimes from suc
in the crib.

Instead of such a rapid course, the same sy
gradually during three or four days, the signi
toms not being appreciated. Sometimes no
present, and the child falls dead after walkin
denly sitting up in bed, or after some other
as a consequence of passion or excitement.

Although such symptoms are more often se
may occur after those of only moderate int
patient has been considered well enough to

doors. One little girl was considered well enough to go coasting, and died suddenly after the exertion.

The explanation of sudden heart failure during or after diphtheria is not always the same. When it occurs at the height of the disease it is sometimes due to cardiac thrombosis, probably always associated with changes in the muscular walls. When it occurs late and follows some sudden muscular effort or excitement without premonitory symptoms of any sort, it is probably the result of changes in the muscular walls—a toxic myocarditis. When prodromal symptoms are present, and particularly when it is accompanied by vomiting, abdominal pain, and disturbed respiration, it is probably the result of a toxic neuritis affecting either the pneumogastric or the cardiac nerves, and is to be regarded as a form of post-diphtheritic paralysis. In many cases, no doubt, changes are present both in the nerves and in the myocardium. The other forms of diphtheritic paralysis which may result fatally, are discussed in the chapter on Diseases of the Peripheral Nerves.

Cases of mixed infection or septic diphtheria.—The symptoms are usually severe from the outset. The exudation in these cases is generally of a yellow or dirty-gray or olive colour, sometimes being almost black from the presence of blood. The membrane is usually extensive, covering the entire pharynx, often extending to the nose and the middle ear, and occasionally spreading to the buccal cavity. There is great swelling of the tonsils and uvula, and it is often impossible to obtain a view of the pharynx; all the evidences of inflammation are usually more marked than in the severe uncomplicated cases. Sometimes the inflammation is of a necrotic character, and there may be extensive sloughing of the tonsils, the uvula, or the soft palate. The nasal discharge is generally abundant, and often very offensive. There is marked swelling of the cervical lymph glands, and frequently extensive infiltration of the cellular tissue of the neck, so that the head is thrown back to relieve the pressure upon the larynx and trachea. The swelling sometimes forms a distinct collar, reaching from ear to ear and filling out the whole space beneath the jaw. The pressure upon the jugular veins leads to congestion and swelling of the face and congestion of the brain.

The general symptoms are those of a severe septicæmia. The temperature is usually higher than in simple diphtheria; it follows no regular course, but is generally high and widely fluctuating, ranging from 101° to 106° F. Dr. Biggs informs me that in the Willard Parker Hospital, in the cases characterized by such high temperatures, where bacteriological examinations have been made *post mortem*, there have been uniformly found either a general streptococcus or pneumococcus infection, usually the former. The pulse is weak, rapid, and compressible. The peripheral circulation is poor, the extremities are often cold, there is extreme muscular prostration, and both vomiting and diarrhœa are frequent. There

may be excitement, restlessness, and activ
and stupor. Nephritis is very frequent a
contains a large amount of albumin and c
blood. Dropsy is not usually present, and
seen. In a large proportion of the children
pneumonia develops. This is indicated
higher temperature, and cough, and often
is not involved. The spleen is usually enl
also. Such severe symptoms continue for
patient may die from the sudden invasion
suppression of urine and uræmic convulsi
cause of death is asthenia or broncho-pneu
while the local disease is at its height. Oc
heart failure, where the signs of local impro

Recovery from this type of the disease i
to escape the dangers of the acute period h
Among the latter may be mentioned: extens
of the cellular tissue of the neck, which
even fatal hæmorrhage, diffuse suppuration
which may develop as late as the end of
week and may prove rapidly fatal, late pneu
paralysis of the heart or respiration, as in th

Complications and Sequelæ.—Most of th
have already been mentioned either under t
toms. It only remains to consider their clin

Otitis is not very frequent. It occur
pharyngeal cases, and is sometimes due to
but more often to mixed infection. The ty
a severe one, and it may be accompanied by
membrane which resemble those of scarlet fe

Broncho-pneumonia is the most frequent
dren. It occurs especially in laryngeal cas
type whether the larynx is involved or not.
at the height of the disease, although it is oc
during convalescence. Other pulmonary c
Pleurisy with a serous effusion may occur
nephritis, and empyema in septic cases. Em
laryngeal diphtheria; it is nearly always ves
and may become general, extending into th
and afterward that of the entire body. P
meningitis are all very rare and are seen chief
severe type. Myocarditis is much more fr
greater or less degree in nearly all severe c
proportion of these does it give rise to distin

connected pathologically with degeneration of the cardiac nerves, and it may be a cause of sudden death at any time during the acute period of the disease or during convalescence.

Thrombosis and embolism are among the less frequent complications. If cerebral, they may cause hemiplegia, aphasia, and sometimes convulsions; if peripheral, they usually affect one of the lower extremities, where they may cause sudden pain, numbness, and coldness of the limb, followed by partial paralysis, œdema, and sometimes even by gangrene. Thrombosis of the pulmonary artery or of the heart may be a cause of sudden death, the symptoms being dyspnœa and præcordial distress, with pallor or cyanosis. Both thrombosis and embolism are associated with a very feeble action of the heart, and generally they are preceded by degenerative changes in its muscular walls.

Hæmorrhages are usually nasal, and while in most cases they are not serious, they may necessitate plugging of the posterior nares. Bleeding from any other mucous membrane may occur, but it is rare except from the mouth. Subcutaneous hæmorrhages are not very infrequent, and are evidence of a very high degree of diphtheritic toxæmia. They usually occur as small petechial spots, but are sometimes extensive. They may be seen upon almost any part of the body, most frequently upon the abdomen and lower extremities; but the most extensive extravasation I have ever seen was in the neck, reaching from the clavicle almost to the ear and covering nearly one lateral half of the neck.

Albumin is present in the urine of almost every case of moderate severity, usually depending upon acute degeneration of the kidney. Severe nephritis is most frequently seen in septic cases. It usually develops at the height of the local disease, but may come during convalescence. The most common form is acute exudative nephritis, in which there are albumin and casts in the urine, but rarely dropsy or signs of uræmia. It is seen in most of the fatal septic cases except those due to laryngeal obstruction, but it is seldom a cause of death. Less frequently acute diffuse nephritis occurs, with dropsy, scanty urine or even suppression, vomiting, and all the usual symptoms of acute uræmia. It may be a cause of death.

Functional disturbances of the stomach are very frequent, and are in fact present in most of the severe cases, but lesions of the mucous membrane are rare. While diarrhœa is often seen without intestinal lesions, the latter are of frequent occurrence. The most characteristic form of inflammation is a follicular ileo-colitis, which seldom goes on to ulceration. It is extremely rare that the membranous form is seen, and then it is generally associated with the presence of streptococci, not diphtheria bacilli. The intestinal symptoms usually begin while the process in the throat is at its height, but often continue for some time after the throat has cleared. Although severe intestinal inflammation is rare, it is a most serious complication when it occurs, which is generally in infants and very young children.

Diphtheria is usually followed by a seve which may continue for weeks. Pneumoni may first show themselves during conval sequelæ. The most important sequel of d neuritis or post-diphtheritic paralysis (page

Diagnosis.—The diagnosis of diphtheria dence—clinical and bacteriological. Whil is, on the whole, more exact, it should not sion of the clinical diagnosis. The prevail clinical evidences of the disease and rely greatly to be deprecated. These means of clusive, but complementary. Bacteriology diphtheria has rendered incalculable service has well been said by Welch, the mere prese the throat of a patient no more proves tha presence of the pneumococcus in his saliva pneumonia. Again, the case may be one yet the bacilli may not be found at the firs are found at subsequent examinations—a th pened in my own experience. The delay th tion of early treatment is a matter of the gre connection with serum therapy. Finally, bec in the throat of a non-virulent diphtheria pseudo-diphtheria bacillus, even a positive re be misleading; but after all this will seldom While in no way detracting from the imme teriological assistance in making the diagn manifestations of diphtheria must be observ same care as heretofore, particularly since th are as yet compelled by circumstances to re nosis. Every one who has seen much of t studied side by side will, I think, admit th cases an accurate clinical diagnosis can be m observation, and in a considerable proportion the remaining one fifth require either a lon continue doubtful to the end. The great group are of the mildest variety and termina accurate diagnosis is of importance more fo the patient himself.

1. **The Clinical Diagnosis.**—In arriving sidered, first, the patient and his surroundings or general symptoms; thirdly, the local evide of diphtheria are greatly increased if the pati of age, if his home is in a tenement house or

a public school where he mingles with children coming from all sorts of homes, and if there are other cases in the family or in the neighbourhood. On the contrary, the chances are much lessened if the patient is over ten years old, if he lives in a private house, if there is no diphtheria in the neighbourhood, and if he does not mingle with children who come from doubtful or infected localities. In tonsillitis a history of repeated attacks is often obtained, and is of some value. If the throat symptoms occur with measles or scarlet fever, the time of their development is of much importance; when they precede the eruption or appear while the fever is at its height, the disease is rarely true diphtheria; while, if they develop at a later period or after defervescence, diphtheria is highly probable.

The mode of onset and the constitutional symptoms are of some importance in diagnosis, but diphtheria develops in such a variety of ways that, taken by themselves, the constitutional symptoms prove little. The onset of diphtheria is more frequently gradual, and the initial temperature is more often low, than is the case with other throat inflammations; but the exceptions are many. Diarrhœa, vomiting, coated tongue, and anorexia, count for little on either side. The presence of a nasal discharge, especially if abundant, ichorous and tinged with blood, the early development of the symptoms of croup, the rapid enlargement of the cervical lymph glands, and the early appearance of albumin in the urine,—all point strongly to diphtheria. Later symptoms which are especially diagnostic are marked anæmia, progressive asthenia, intense toxæmia often with a low temperature, very feeble pulse which is sometimes slow, sometimes rapid, sudden attacks of syncope, nasal hæmorrhages, nasal regurgitation from paralysis of the soft palate, contagion, and, finally, the development of post-diphtheritic paralysis of the muscles of the throat, eye, or extremities, with paralysis of the heart or respiration.

For early diagnosis much more reliance is to be placed upon the local appearances than upon the general symptoms. The characteristic membrane of diphtheria appears, in the great majority of cases, first upon the tonsils usually as a gray film, which gradually becomes more dense and white, and often has the look of being plastered on. The colour of older membrane is gray, greenish-yellow, brown, sometimes black. Beginning as a small patch, it soon spreads so as to cover the tonsils. It frequently affects one tonsil twenty-four or thirty-six hours before the other, and occasionally it is confined to one side. In exceptional cases it begins in the crypts of the tonsil and appears as isolated dots, which may coalesce to form a continuous patch like that already described, or it may remain isolated like the exudate of an ordinary follicular tonsillitis. When the membrane is removed it usually requires some force, and the entire patch may come away, leaving bleeding points, but it reforms in most cases within twenty-four hours. More important still for diagnosis is the fact that the membrane spreads from the original seat, and also the manner of

its spreading. If it extends from the tonsi
uvula, it is almost surely diphtheria; so also
to the lateral walls of the pharynx. Doub
fauces followed by symptoms of croup, m
with almost absolute certainty. The ra
much in the different cases, depending up
tion; but the gradual extension beyond th
tions made at intervals of eight or twelve
nosis in the primary cases. However, if th
measles or scarlet fever the above rules do n
judged by the time at which the membrane

In pure diphtheria there is a notable abs
pillars and uvula, so common in throat inf
fact, whenever there are seen in the throat e
of inflammation, it points either to mixed i
The same is true of a very friable membra
presence of pus cells, and also of deep slou
lars of the fauces.

Primary membranous inflammation of th
regarded as diphtheria; but if there is no vi
is rendered positive only by a bacteriologic
true of many nasal cases where the only sy
character previously described. Such cases
no symptoms other than the discharge. So
catarrhal diphtheria; in others, membrane
space or in the nose itself.

The most characteristic clinical differe
other inflammations accompanied by an exu
the nose—i. e., pseudo-diphtheria—are show

DIPHTHERIA.	
1. Often a history of exposure to a previous case.	1. U
2. Prevails epidemically.	2. It
3. Onset often gradual, with low temperature and slight constitutional symptoms.	3. O perature sympto
4. Previous attacks rare.	4. Of
5. Often begins in the larynx.	5. Se
6. If pharyngeal, often shows a strong tendency to extend to the larynx.	6. Th
7. Primary cases frequently severe.	7. Ra ticularly
8. When it complicates measles or scarlet fever it often develops late, after primary fever has subsided.	8. Us primary the erupt

DIPHTHERIA.	PSEUDO-DIPHTHERIA.
9. The middle ear not so often involved.	9. Much more frequently; in scarlet fever almost invariably.
10. Occasionally limited to the nose (croupous rhinitis).	10. Doubtful if it ever is so.
11. Adenitis constant; not much surrounding inflammation, except in cases of mixed infection; suppuration is rare.	11. Adenitis often slight or absent in primary cases; in scarlet fever, marked inflammation which extends to tissues around the glands; frequently suppurates.
12. Albuminuria the rule, except in the mildest cases.	12. Rarely seen in primary cases, and sometimes not in secondary form, even though the symptoms are severe.
13. Nasal regurgitation from paralysis of the palate in the second week or later.	13. Never seen.
14. Toxic symptoms common: asthenia; great anæmia after the fourth or fifth day; later, sudden heart paralysis, respiratory paralysis, or post-diphtheritic paralysis of throat, eyes, or extremities.	14. Septic symptoms frequent, but the peculiar toxic symptoms are never seen.
15. The membrane usually thicker and more adherent; can often be removed in large masses.	15. Thinner, more friable, and less adherent; rarely removed in large masses.
16. Greater tendency to spread from its original seat.	16. Tendency much less; in most primary cases membrane limited to tonsils.
17. Longer duration noticeable, especially in mild cases, where it may last five to ten days.	17. Shorter duration; three to five days.
18. Usually less evidence of inflammation of mucous membrane and in surrounding parts.	18. Evidence often of intense inflammation.
19. After removal of membrane a red surface left; ulceration slight and superficial; rarely a tendency to sloughing.	19. In bad cases, often marked ulceration with deep sloughing and suppuration.
20. A very extensive membrane of a white or pearl-gray colour, covering tonsils, uvula, fauces, pharynx, and nose, is almost invariably true diphtheria, if primary.	20. An exudation of isolated yellow dots which never coalesce, confined to the tonsils, with considerable swelling and evidence of inflammation and usually with a high temperature, is seldom true diphtheria.
21. A thick gray membrane, not removable without force, with little or no inflammation, and although confined to the tonsils lasting five or six days, is almost invariably true diphtheria.	21. An exudation of soft, yellow patches, changing to a dirty green, which can be partly or entirely wiped off without hæmorrhage, whether confined to the tonsils or extending to the pillars of fauces and lasting only three or four days, is seldom true diphtheria.
22. A membrane on the tonsils, similar to that described, with isolated adherent patches on the uvula or anywhere in the pharynx, is usually diphtheria; doubtful patches upon the tonsils followed by croup, almost invariably diphtheria.	22. Cases with much general inflammation of the tonsils and pharynx, with small patches of a yellow exudate, are seldom true diphtheria.

The difficulties of diagnosis are greates
early stage. There are very few cases, exce
which a diagnosis is not possible by the co
are very many in which an early diagnosis

It is not often difficult to distinguish
ease; but the exudation upon the pharynx
with thrush or herpes. This mistake can
examines a case with any degree of care.
on the second or third day after tonsillot
be easily mistaken for diphtheria by one w
pearance of the wound.

Diphtheria of the mouth may be mista
stomatitis. It is, however, much more com
to be called diphtheria than for the opposit
theria of the mouth alone is so rare that it
consideration. As a rule, this is seen only
geal diphtheria.

It is sometimes difficult to distinguish
the throat symptoms are severe and appea
diphtheria. In many of these cases the er
characteristic. Much importance is to be
scarlet fever, to a prevailing epidemic, a
onset with severe symptoms, vomiting, prost
and to a very active inflammation in the
sudden onset, in which from the throat sym
a diagnosis of diphtheria, the possibility o
forgotten; and one should never omit to ex
for an eruption. The diagnosis of primary
already been considered (page 447).

2. **The Bacteriological Diagnosis.***—*The*
immediate diagnosis may be reached by s
swab which has been drawn over the diphth
glass is then dried and stained. Although
method is fairly exact, it is not adapted to
from the throat are much less typical than
chances of contamination are much increase
often contains bacilli which somewhat resen
that on the whole the result is more likely t
are made.

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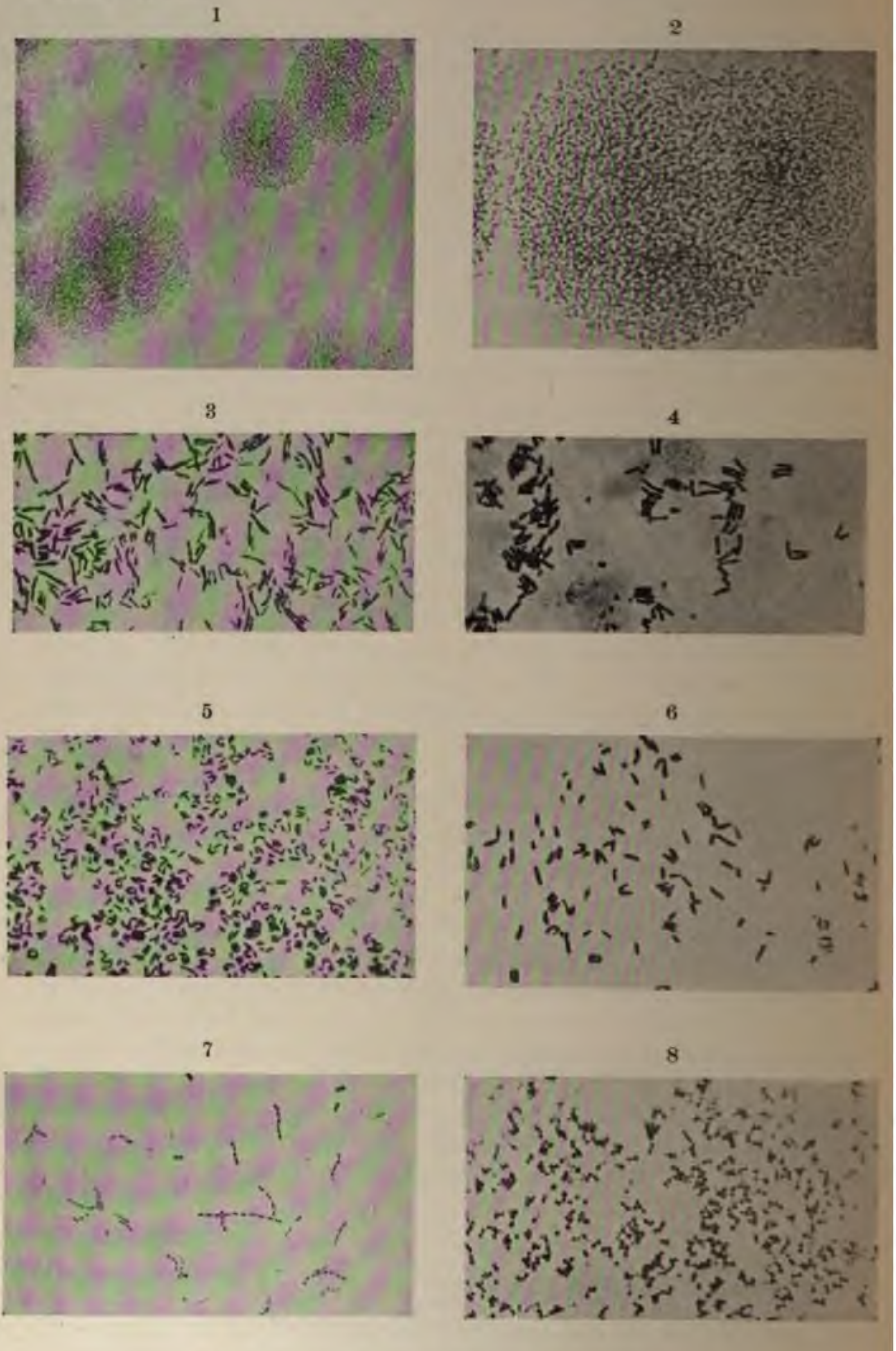
* I am greatly indebted for many facts in thes
No. 1, of the New York Health Department, in whos
the supervision of Drs. H. M. Biggs and W. H. Pa
world in the bacteriological diagnosis of diphtheria

PLATE XVIII.



Diphtheria Bacilli and their Associates.

1 and 2, colonies of diphtheria bacilli under a low and a high power; 3, 4, 5, characteristic diphtheria bacilli × 1,000; 5, showing the short even-stained diphtheria bacilli; 6, pseudo-diphtheria bacilli; 7, streptococci from a serum culture; 8, streptococci from a smear directly from the throat. (After Park.)

In making cultures there is required a sterilized swab and a tube or plate of Loeffler's blood-serum (page 952). The swab is made from a piece of wire roughened at one end where it is wound with absorbent cotton. In taking a culture from the throat, the tongue should be depressed and the tonsils, pharynx, or other seat of visible membrane rubbed firmly with a swab, which is then rubbed over the surface of the culture-medium in the tube or on the plate. In laryngeal cases the culture should be taken from the posterior wall of the pharynx, and in nasal cases from the nostril. The tube or plate is then placed in an incubator for twelve or fourteen hours and kept at a temperature of about 100° F. (37° C.), at the end of which time the colonies (Plate XVIII, 1 and 2) may be examined. A sterilized platinum needle is dipped into a colony and washed off in a drop of sterilized water upon the cover-glass, dried in the air, and then heated by passing several times over an alcohol flame and stained for ten minutes with Loeffler's solution of alkaline methyl blue, without heating; after which it is rinsed, dried, and mounted in balsam. Examination with an oil-immersion lens, in the great majority of cases, shows either a great number of diphtheria bacilli (Plate XVIII, 3, 4, and 5) and a few cocci, or only cocci in pairs or short chains (7 and 8); exceptionally, the cocci and bacilli may be present in nearly equal numbers.

Although the first slide may seem conclusive, a positive opinion should not be given without examining at least three colonies from different parts of the specimen. The diagnosis is completed by testing the virulence of the bacilli found. This is usually done by injecting a guinea-pig with a pure broth-culture. When death occurs within seventy-two hours, the bacilli are said to be fully virulent.

The reliance to be placed upon bacteriological diagnosis.—Many misleading statements have been published in regard to the relative frequency of cases of membranous inflammation due to the diphtheria bacillus and to other bacteria. My own experience coincides fully with the statements made by Welch and Baginsky, that in the great proportion, fully ninety-five per cent, of the cases in which one would unhesitatingly make the diagnosis of diphtheria by clinical symptoms, the Loeffler bacillus is found, provided proper precautions are observed. It will almost invariably be found: (1) if there is visible membrane in the pharynx; (2) if the culture is made during the period in which the membrane is forming; (3) if no antiseptics have been applied shortly before using the swab; (4) if the culture has been made with sufficient care to avoid contamination.

The diphtheria bacillus sometimes disappears early; hence cultures made while the membrane is loosening may be negative. If the membrane has disappeared, or if none has been present, it may be necessary, as has been shown by Koplik, to go into the tonsillar crypts with probe or

spoon to discover bacilli.* It is therefore i
sider the duration of the disease before draw
tive culture. If the case is one of larynge
exudation, a negative culture from the phar
uncommon, although a little later bacilli m
in the pharynx in abundance. Hence negat
late in pharyngeal and early in laryngeal cas
is never to be taken as conclusive, although i
those mentioned it may be so regarded.

The next question for consideration is
the microscopical appearances of bacilli and
in deciding that they are virulent, without re
inoculations. The consensus of opinion amo
ent time is that, for diagnostic purposes, all
throats, having the morphological and cult
theria bacilli are to be regarded as virulent u
the latter being very infrequent. This is equ
mild and severe cases, for it is well known t
are often found in cases clinically of a mild t

Non-virulent bacilli resembling the Loef
found in throats two forms of bacilli which r
lus and which may occasionally be a source of
virulent diphtheria bacillus, a form which
characteristic with the Loeffler bacillus, but wh
by animal tests. The exact status of this form
The view most widely accepted is that of Rou
are simply diphtheria bacilli which have lost
form, though in many particulars resembling
from it in being shorter, plumper, and more
ducing an alkali in broth cultures; to this
bacillus † (Plate XVIII, 6) has been given.
than the form just described and like it is non
of bacteria are rare in throats where a suspicio

The presence of virulent bacilli in the th
That virulent bacilli may be harboured for an in

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* Dr. Martha Wollstein, pathologist to the Babies'
following case illustrating this point: The first swal
the tonsil revealed the Loeffler bacillus. The case was
who a day or two later took a culture from the throat,
disappeared, and reported the case as negative. On
made a second culture from the tonsillar crypts, find
in great numbers. Such cases indicate how great cauti
conclusions from negative cultures, especially if made

† An unfortunate term, as this bacillus has nothin
classed as pseudo-diphtheria, which is generally due to

or nose of a healthy person is proved by many observations. In Escherich's well-known case, the throat of an apparently healthy nurse, under whose care a number of cases of diphtheria had developed, was found to contain numerous virulent bacilli which remained for weeks. In a case observed by Park, virulent bacilli were found for months in the nose of an apparently healthy infant, and this child communicated diphtheria, it was believed, to two other members of the family, without itself ever suffering from the disease. Similar instances have been reported by Feer, Loeffler, and others; but they are to be regarded as very exceptional. However, the presence of bacilli in the nose or throat of a child who has recently been exposed to diphtheria is of very common occurrence. The New York Health Department made observations upon forty-eight children in fourteen families in which one or more cases of diphtheria had occurred, and where no attempt at isolation had been made. In one half these cases bacilli were found, and animal tests showed them to be virulent in every one of six cases tested, although four of the children did not develop diphtheria. Of the entire number, forty per cent subsequently developed diphtheria. My own experience in two institutions where diphtheria has been endemic, fully confirms the observation that bacilli of all degrees of virulence are very frequently found in the noses or throats of such exposed children, although a large proportion of them never develop the disease. Outside of institutions and infected tenement houses, however, such a condition is extremely rare. In a series of three hundred and thirty cases studied by Park, in which no exposure to diphtheria was known, virulent bacilli were found in but eight persons, two of whom subsequently developed the disease. In twenty-four of this series, nonvirulent diphtheria bacilli were found, and in twenty-seven the pseudo-diphtheria bacillus. Any person, but especially a child who has been in contact with a case of diphtheria, may receive bacteria into the throat, where they may be present for days or weeks before the disease develops, and such persons may convey the disease to others, although they themselves may never have it.

Summary.—1. For ordinary diagnostic purposes the discovery in the throat of a case of suspected diphtheria, of bacilli having the appearance of the Loeffler bacillus, may be regarded as conclusive evidence of diphtheria.

2. Cultures may yield negative results late in pharyngeal cases when the membrane is separating or after it has disappeared, or early in laryngeal cases; but in no instance is a single negative culture to be regarded as conclusive.

3. Both the local appearance of the throat and the stage of the disease are always to be considered in connection with the bacteriological report.

4. Virulent bacilli are frequently found in the noses or throats of children exposed to diphtheria, apart from all throat lesions. Such a finding is not in itself evidence that these persons have diphtheria, although,

inasmuch as they may infect others and as them subsequently develop diphtheria the garded with suspicion and if possible kept u

5. Non-virulent bacilli are occasionally, found in the throats of healthy persons wher ure to diphtheria.

6. The existence of a membranous infla ynx, associated with the presence of diphth dence of the existence of diphtheria.

7. The presence of such bacilli, associat catarrhal inflammation of the mucous mem diphtheritic infection.

Prognosis.—There is no disease in which the outcome than in diphtheria, and none pected dangers more often arise. So many p mildest case must be regarded as serious an can never know when unfavourable sympton it well when he says, "The physician will frequently in mild cases than in severe ones of cases it is impossible to tell how severe th third or fourth day of the disease.

The factors to be considered in the progn age and previous condition of the patient begun; the extent of the membrane and t spreading; the degree of diphtheritic toxæn of the pulse and the nervous symptoms; whe invaded the larynx; and the presence or ab cially nephritis and broncho-pneumonia. P better prognosis than cases of mixed infectio

So many circumstances modify the death- are of no value for comparison unless their must always be taken into account, the age whether the statistics are drawn from privat latter, what sort of cases are received at the employed. Diphtheria is very fatal during from two causes: first, from its strong tende lower air passages; and secondly, from the fr pneumonia occurs as a complication, both in the larynx and trachea. Of eighty-five co six months of age observed in the New York extending over two years, the mortality wa thirds of the fatal cases the disease involved hospitals, where most of the mild cases incl would probably not have been admitted, the two years has varied from 60 to 80 per cent; in private practice it has ranged for this age from 30 to 60 per cent—i. e., without antitoxine.

After the second year there is a steady fall in the mortality up to puberty. From a comparison of many statistical tables it may be stated that, under the same conditions, the mortality from two to five years is two thirds the mortality of the first two years; while that from five to ten years is one half, and that from ten to fifteen years about one fifth the mortality of the first two years. Series of cases from different sources and treated by different methods show very nearly this relative mortality.

In some seasons a mild type of the disease prevails, the number of laryngeal cases is small, and the mortality therefore is less than half that which is usually seen. In other seasons, with the opposite conditions, the mortality may be trebled. The influence of the method of treatment upon the mortality will be considered in the pages devoted to treatment.

There has been considerable discussion as to what influence the general introduction of bacteriological diagnosis has had upon diphtheria statistics. While many cases of pseudo-diphtheria, most of which recover, have been excluded, there have been included many cases formerly regarded as examples of simple tonsillitis. According to the data collected by the New York Health Department, there are excluded by bacteriology more cases than are included. In April, 1896, there were reported to the Department as diphtheria (without a bacteriological examination) 107 cases which were proven by cultures to be pseudo-diphtheria; while during the same month there were 80 cases returned as doubtful or as pseudo-diphtheria, which by bacteriological examination were proven to be true diphtheria. The results obtained in several other months were very similar.

It can not be too often emphasized that the danger from diphtheria is not over when the throat has cleared off. The most frequent cause of death after this time is heart paralysis, which may come very suddenly. This danger exists after every severe case and it occasionally occurs after those in which the early symptoms were only of moderate severity. Less frequently death late in the disease is due to paralysis of respiration, to nephritis, or to broncho-pneumonia.

Prophylaxis.—In no infectious disease can so much be accomplished in the way of prevention as in diphtheria.

Public funerals of children dying from diphtheria should at all times be prohibited. Schools should be closed whenever the disease is epidemic. Children from families where diphtheria exists should not be allowed to attend school, not only ordinary day schools, but Sunday schools, dancing schools, and the like; first, for the reason that they may, while healthy, be the carriers of the disease, but, what is even more important, that they may mingle with other children while themselves suffering from diphtheria in an early stage or in a mild form. Such children should be kept from school for at least two weeks after the recovery of the last case in the family.

In every large city, hospitals for diphtheria patients should be established, not only for the poor, but with private rooms for cases developing in hotels, boarding houses, or in any place where isolation is impossible. The removal of diphtheria patients from tenement houses to a hospital should be insisted upon whenever there are other children in the family. Every city should be provided with a steam disinfecting plant, where carpets, blankets, bedding, etc., can be sent from the sick-room for disinfection. It is also desirable that the board of health in every city have a bacteriological laboratory,* where the diagnosis in all doubtful cases may be settled by means of cultures, in order that proper and necessary means of prophylaxis may be taken in every case of true diphtheria, even though it is mild, and also that unnecessary expense and trouble be not imposed in cases of pseudo-diphtheria.

Quarantine.—Not only every undoubted case of diphtheria, but every suspected case, should be immediately isolated. Quarantine for the latter should continue until the diagnosis is settled either by a bacteriological examination or by the course of the disease. Positive and suspected cases should not be isolated together. The quarantine in every instance must be complete; no person should be allowed in the room except the attendants and the physician. The meals and everything else required by the patient should be left outside the door.

Bacteriology has furnished some very definite data from which the necessary duration of the period of quarantine may be determined. In this the physician is to be guided by the time that the bacilli remain in the throat, for the patient is to be considered as dangerous while they persist. This point was investigated by the New York Health Department in 605 cases: In 304 of these the bacilli had disappeared by the third day after the membrane was gone; and in 301 they persisted for a longer time,—in 176, for seven days; in 64, for twelve days; in 36, for fifteen days; in 12, for twenty-one days; in 4, for twenty-eight days; in 4, for thirty-five days; and in 2, for sixty-three days. While it is unquestionably true that in a certain number of cases these persistent bacilli have been found non-virulent, the opposite has been frequently shown. Of 15 cases in which the virulence was tested, virulent bacilli were found in 9 at periods varying from eight to twenty-five days after the membrane was gone. Tobiesen found that of 46 patients leaving the hospital under ordinary rules, virulent bacilli were present in 24 at the time of their discharge. The general rule should be to continue quarantine until a culture shows the throat to be free from bacilli; in the absence of the culture test, quarantine should be continued in mild cases for ten days, and in severe cases for three weeks, after the membrane has disappeared. The danger after this period in either instance is very slight; for even where virulent bacilli are found long after the membrane has disappeared, their number is usually small. The rules above given should be followed with reference to children returning to school or mingling with other children, and adults who are thrown into close contact with children.

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* The example of the New York Health Department in establishing a municipal laboratory for the bacteriological diagnosis of diphtheria has now been followed by nearly every large city in this country.

Treatment of suspected cases.—During an epidemic of diphtheria every sore throat should be looked upon with suspicion, and every such case isolated as soon as any exudation appears upon the tonsils, or a watery nasal discharge begins. In institutions it is desirable that cultures be made from suspicious cases of pharyngitis, even though no membrane is present. All such patients should be separated from the other inmates of the home or the institution, and while waiting for the results of the bacteriological examination or for positive symptoms, antiseptic gargles should be used. If there are patches on the tonsils, the case should be treated as true diphtheria, in order that no time may be lost. If the bacteriological examination shows the disease not to be true diphtheria, the patient may be released from quarantine in two or three days, provided the throat symptoms disappear. It is, of course, important that the conditions laid down with reference to bacteriological diagnosis shall have been fulfilled. Should symptoms continue, however, a second culture should be taken, since the bacilli at the first examination may have been so few as to have escaped the swab.

Treatment of children exposed.—When a case of diphtheria occurs in a family or an institution every child that has been exposed should receive an immunizing dose of antitoxine. Although many points regarding immunization are still unsettled, there can be no doubt that for a limited time, probably about a month, the serum confers almost complete protection.

Some of the most striking evidences of the value of the serum for immunization have been obtained in New York institutions, especially in the Nursery and Child's Hospital and the New York Infant Asylum, both of which have been under my own observation. The results in these institutions, together with those obtained elsewhere, are shown in the accompanying table, which was prepared by Biggs.*

In the two institutions first named in the table, many infants under three months old were injected, and several under a week old, without anything more than transient disturbances. In one of these institutions 21 pregnant women and 8 women in the puerperal state were injected; there

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* The Medical News, November 30, 1895.

was no reaction in any of them, and, thou
daily for a week, in none did albumin appea

Table Showing the Results of Antitoxine I

PLACE OF OBSERVATION.	Children immunized.	Cases of diphtheria developing among those immunized between 1 and 30 days.	Cases developing within 24 hrs.
New York Infant Asylum (1st immunization.)	224	1 mild on the 19th day.	0
New York Infant Asylum (2d immunization).	245	1 mild on the 12th day.	0
Nursery and Child's Hospital.	136	0	0
New York Juvenile Asylum.	81	0	0
New York Catholic Protectory.	114	0	1
Bellevue Hospital......	11	0	0
Health Department inspectors.	232	1 mild on the 19th day.	3
Total.............	1,043	3	4

In the Bulletin of the New York Heal
together twenty-nine reports, covering 15,98
exposed persons for the purpose of immuniz
with diphtheria during the thirty days follov
0·5 per cent. Nearly all of these had a mild
case being fatal. Many of these injections w
antitoxine, and doses now regarded as insuffic

The dose for immunization is from 50 t
that required for an infant under three mont
of twelve or fourteen years; for one from fi
is 200 to 300 units. With the strongest ser
be administered in a volume of ten minims.

If possible, cultures should be made fro
children, and those having no bacilli shou
house. Children whose throats contain bacil
others, but not necessarily confined in-doors.
should use a gargle of bichloride, 1 to 5,000.
is wise to spray, or better, to syringe the n
simple saline solution, two or three times a d
children should be carefully inspected twice a
general rules should be adopted.

Nurses.—Those in charge of diphtheria
munizing dose of antitoxine of 300 or 400

tracted, not from the breath of the patient or the air of the room, but by receiving the bacilli into the mouth or air passages, all possible means should be taken to destroy the bacilli discharged, and to secure absolute cleanliness in everything about the sick-room. Nurses should never be allowed to eat or sleep in the sick-room, and an antiseptic gargle should be used four or five times a day. The hands should be kept clean, and only such dresses worn as can be readily washed and disinfected. It is the nurse who is most likely to contract the disease, on account of the continued exposure. Hence, these measures should be rigorously insisted upon. She should be allowed a few hours in the open air every day.

Physicians.—The physician should take the same precautions as in scarlet fever (page 907). A pocket tongue-depressor should not be used for the examination of the throat, but a spoon which is kept in a solution of carbolic acid, 1 to 40. In order to prevent the coughing up of mucus or membrane in the face of the physician, a pane of ordinary window glass may be held in front of the patient's face during inspection of the throat.

The sick-room.—The carpets, hangings, upholstered furniture, everything in fact not necessary for the patient's welfare, should be removed, especially books, toys, cushions, etc. The room should be a large one, if possible with an open fireplace, well ventilated, and fresh air should be allowed in abundance. The floor should be washed once a day with a solution of bichloride, 1 to 2,000, and dusted often with cloths moistened in the same solution. All handkerchiefs, bed linen, and clothing removed from the patient should be treated as in a case of scarlet fever. Pieces of membrane and other matters discharged from the patient should be put into a solution of carbolic acid, 1 to 20, or of bichloride, 1 to 1,000. Pieces of old muslin or absorbent cotton should be used to cleanse the nose and mouth of the patient and burned immediately. All vessels for the reception of expectoration or other discharges should contain bichloride, 1 to 2,000. The bed-linen should be very frequently changed, and everything kept scrupulously clean. In the room should be a large bowl of carbolic acid, 1 to 40, or some similar solution for the cleansing of hands, and a tray of the carbolic solution for spoons, syringes, or other things used in the treatment of the patient. All spoons, cups, or other dishes used by the patient should be carefully sterilized by boiling for twenty minutes. No milk or other food should be allowed to stand about the room. There is no objection to the hanging of sheets moistened in carbolic, bichloride, or other disinfectant solutions before the door, but neither this nor hanging them about in the sick-room is to be regarded as having any value in disinfecting the air of the room. They create a false sense of security, and often lead to the neglect of thorough cleanliness, which, after all, is the essential thing.

Disinfection of apartments after an attack should be done as after scarlet fever (page 907).

Treatment.—*General measures.*—It is important in every case that there should be plenty of fresh air in the room throughout the attack. Where it is possible, it is desirable to have two rooms for the patient, so that he can be changed from one to the other every day, giving time for thorough cleanliness and airing. In hospital wards, patients should never be crowded together. Small wards, containing three or four beds, are much to be preferred to very large ones. Even in mild cases the patient should be kept in bed throughout the entire attack, and in severe cases this should be continued for some time during convalescence. It is especially important where there have been symptoms of cardiac depression during the acute stage.

Nursing infants may be fed on breast milk obtained by a breast pump, but should not be put to the mother's breast. The feeding of older children must be managed very much as in other cases of severe illness (page 191). Milk is the main reliance; it should usually be diluted, and for younger infants often partially peptonized. The greatest difficulty in feeding is seen in the latter part of the disease, when the patients are septic and have a strong aversion to food, when vomiting is easily excited and when swallowing is difficult on account of the swelling and pain. It is then that forced feeding by means of gavage is most valuable. This is much more successful with children under three years old than is rectal feeding. In children of five or six years, who struggle against the tube in the mouth, it may be passed through the nose with very little difficulty. The results are, as a rule, extremely satisfactory, and gavage may be used with advantage in many intubated cases.

Stimulants.—There is no question in regard to the value of alcohol in diphtheria. It is altogether the most powerful drug we possess to combat the effects of the disease upon the nervous centres and the heart. Stimulants should be begun as soon as the depressing effects of the poison of diphtheria are shown upon the pulse and general condition of the patient. In most cases, therefore, they are not needed until the third or fourth day; in a few they may be required from the outset, and in some they may not be required at all. The indications for alcoholic stimulants are marked prostration, a feeble pulse, and a weak first sound of the heart. In regard to the quantity, one ounce of whisky or brandy in twenty-four hours is enough to begin with, for a child four years old. This should be diluted with at least six parts of water. In very bad cases five or six times as much may be given; the only limit to the quantity is the tolerance of the stomach. The method of administration should be the same as in other severe acute diseases (page 49). Usually stimulants should not be combined with food. A child is more apt to rebel against the stimulants than the milk, and it is important that nothing be done to interfere with the taking of proper nourishment. Other heart stimulants than alcohol, though inferior to it, are of value in some cases. The most useful one is strychnine, which should be given as in pneumonia (page 510). Camphor and carbonate of ammonia are valuable for rapid effect in syncopal attacks, and digitalis in other cases where the pulse is weak and arterial tension low, but it is not wise to give it in large doses. In cases of threatened heart paralysis occurring late in the disease or during convalescence, nothing is so valuable as morphine hypodermically. Full doses must be given and repeated every two to four hours, so that the child may be kept completely under its influence.

Except for stimulation or the control of special symptoms such as vomiting or diarrhœa, all internal medication would better be omitted; for there is yet wanting proof that drugs influence the course or the result of the disease.

Local treatment.—Since the introduction of antitoxine, medical opinion has undergone a decided change with reference to local treatment. While it is not desirable that it should be entirely abandoned, still it has assumed a position of secondary importance; and under conditions where it can be carried out only with great difficulty and the use of considerable force, as in the case of very young or intractable children, it is often wise not to attempt it systematically.

The purpose of local treatment, it is now generally agreed, should be cleanliness, and not the destruction of bacilli. Cleanliness of the nose, mouth, and pharynx is important, inasmuch as one of the chief dangers of the disease is the aspiration of bacteria contained in the abundant secretions of these parts, into the larynx and bronchi. Our aim should therefore be to keep the parts as clean as possible without too severely taxing the strength of the child. Harm often results from attempting to do too much.

For cleansing the nose and rhino-pharynx only syringing can be depended upon. Nasal syringing is indicated when there is much nasal discharge, whether membrane is visible in the anterior nares or not, unless there is so much resistance on the part of the child that it can not be done without a good deal of force. In such cases more harm than good may result. However, in septic cases with a profuse fetid discharge it may be necessary to syringe the nose, no matter how strongly the child resists. Whether it shall be done forcibly in such a case, will depend upon the condition of the patient's strength and his pulse. The purpose in syringing is not so much to clear the nose, from which absorption is slow and imperfect, although this is useful, as to flush the rhino-pharynx, from which absorption is always very active. Only bland solutions should be employed, such as a common-salt solution, strength of one per cent, or a boric-acid solution, one to four per cent strength.

For ordinary cases, the syringe and the method described on page 57 may be used. For some cases a fountain syringe possesses manifest advantages, and it is rather more convenient for hospital purposes. All solutions should be used lukewarm, and in sufficient quantity to irrigate the parts thoroughly, a few such irrigations being much better than a great many partial ones. By a skilful nurse syringing can in most cases be done with comparatively little disturbance to the child.

Slight nasal hæmorrhages may necessitate less frequent syringing, and a free hæmorrhage may oblige us to stop it altogether. Astringent solutions of alum, Monsel's solution, lemon juice, etc., are sometimes beneficial in such cases, but they must be largely diluted. In children who are old enough to use them, the mouth and pharynx should be kept clean by gargles. A solution of boric acid, listerine, or Dobell's or Seiler's solution much diluted, may be employed.

In cases with a moderate nasal discharge it is usually sufficient to syringe three or four times a day; but in those of the most severe or septic type, with very abundant discharge, syringing should be repeated as often as every two hours during the day and every four hours at night.

External applications to the throat have practically no effect upon the disease, but are often useful to relieve pain and tension in the swollen lymph glands. In very young children heat is to be preferred to cold, and may be applied either by means of poultices, or, better, spongiopiline wrung from very hot water, covered with cotton and then with oiled silk; prolonged poulticing should not, however, be allowed. For older children an ice-bag may be used, and this frequently gives great relief.

The Serum Treatment.—This has been the outcome of a long series of experiments in which many men have had a share; but it is to Behring pre-eminently that the credit belongs for the development of the principles of serum-therapy. It will be sufficient here to indicate the more important steps which have led to this discovery. In December, 1890, Behring and Kitasato published experiments which demonstrated that it was possible for the blood of an immunized animal (one which had been injected with the toxines of a disease in gradually increasing doses, until a condition was reached when such injections produced no reaction) when injected into another animal to convey immunity, and also cure the disease if artificially produced. This was first shown to be true of tetanus. In August, 1892, Behring further showed that the blood of an immunized animal had the power both of protecting and curing susceptible animals which had been inoculated either with the toxines or with the bacilli of diphtheria. Early in the same year he produced from animals his so-called "normal" serum, which was used in his animal experiments, this being one sixtieth of the strength of his No. 1 serum now employed. The further steps consisted in gradually increasing the strength of the serum by the use of stronger toxines for injection. Up to this time small animals had been used, and the serum produced only in limited quantity. Later, Roux conceived the idea of using horses for injection, and from this time they were generally employed. In the latter part of 1893 the serum was first tried upon diphtheria patients in the Berlin hospitals, and, although it was still very weak, encouraging results were observed. At the International Congress held at Rome in March and April, 1894, Heubner reported his results in cases treated by the serum, followed the same month by a report from Ehrlich, Kossel, and Wassermann, with two hundred and twenty cases, which up to that time had been treated with antitoxine, showing a decided reduction in the death-rate. The results improved steadily with the strength of the serum employed. By August, 1894, the beneficial results of the serum were considered sufficiently established to warrant placing Behring's serum on sale. The new treatment attracted but little notice until the Congress at Buda-Pesth in the summer of 1894, where Roux presented a report of three hundred cases treated at Paris under his supervision, with results so striking that the interest of the entire medical profession was at once aroused. Since the beginning of 1895 the serum treatment has been tested on a large scale all over the world.

Regarding the nature of the antitoxine and its mode of action but little is as yet definitely known. Two theories have been advanced: one, that its action is a chemical one, directly neutralizing the toxine of diphtheria; the other, that its effect is rather a vital one, rendering the cells tolerant of the diphtheria toxine. Without being in any sense germicidal in its effect, the antitoxine produces a condition in the blood which arrests the growth of the diphtheria bacillus and the membranous inflammation which this excites.

Following the plan of Roux, the diphtheria antitoxine is produced at the present time from the blood-serum of the horse. This is drawn into sterilized vessels and preserved in small sterilized bottles, each of which is designed to contain a sufficient quantity for a single dose. It is preserved by the addition of carbolic acid (Behring), camphor (Roux, New York Health Department, and others), or some other antiseptic. Properly prepared, it will keep without deterioration for from three to six months; but after one year it loses somewhat of its antitoxic properties, this amounting, according to the experiments of Park, to perhaps one third of its original strength. It should be kept in a cool, dark place, and after a bottle has been opened it should be used within a few days. The effort to prepare and preserve the antitoxine in a dry form has not thus far been very successful.

The strength of the serum is measured in antitoxine units, the unit being an arbitrary one and representing the ability to neutralize a definite quantity of diphtheria toxine. The improvements in the production of the serum have thus far consisted in increasing its strength. Behring's normal serum as first used contained in each cubic centimetre (15 minims) one antitoxine unit; that sold as Behring's No. 3 contains 150 units in each cubic centimetre. Several American manufacturers have now placed on sale a serum containing 500 units in each cubic centimetre, and have produced one containing 750 units in each cubic centimetre. There may now be obtained also an "extra-potent" Behring's serum which contains 500 units in each cubic centimetre. The stronger serum has been produced by the use of stronger toxines for animal injections, those at present employed being many times stronger than those formerly regarded as the strongest possible.

The concentration of the serum is of immense advantage, and has simplified many things in connection with its administration. Horse-serum being merely the vehicle of the antitoxine, and itself, it is believed, capable of producing unpleasant effects when large quantities are injected, it is desirable to administer the dose of antitoxine in the smallest amount of serum possible. There seems now to be good evidence that the local discomfort—œdema, pain, etc.—and also the various eruptions, which sometimes follow its use, have depended largely upon the amount of horse-serum injected. With the concentrated serum now available, it is never necessary to use more than 5 cubic centimetres (75 minims) for a single dose, and usually but half this quantity. This does away with the necessity for large and special syringes. The hypodermic syringe as made for veterinary use, holding 5 cubic centimetres, answers every purpose, and is, I think, to be preferred on account of the smaller size of the needle. For nearly a year I have used no other instrument. The syringe should be rinsed with alcohol immediately before using, and the needles should always be boiled. Care should be taken that all air is expelled from the syringe before the injection is made. The seat of injection is of comparatively little importance now that the dose of antitoxine can be given in so small a volume. The cellular tissue of the abdomen or the thigh is perhaps the best location. If a small needle is used, no application of adhesive plaster is necessary; but the needle puncture should be covered with the finger for a few moments.

Rules for accurate dosage in antitoxine are as yet impossible. It is desirable to give in every case enough to neutralize the amount of diphtheria toxine present in the blood, but we have no very exact means of determining how much this is. It depends upon the virulence of the bacilli—which may be judged by the severity of the attack and the extent of the membrane—the time when the injection is made, and somewhat upon the age of the patient. The general experience of the profession thus far is, that for children over two years old the initial dose should be from 1,500 to 2,000 units in all severe cases, including those of laryngeal stenosis, this dose to be repeated in from twelve to sixteen hours if no improvement is seen, and again in twenty-four hours if the course of the disease is unfavourable. The third dose is rarely necessary. Exceptional cases of great severity, especially when seen late, should receive somewhat larger doses than those mentioned—i. e., 3,000 units. Mild cases should receive 1,000 units for the first injection, a second being rarely required. For children under two years old, the initial dose in a severe case or one of laryngeal stenosis should be 1,000 units, to be repeated as above indicated; in a mild case, 600 units. The most concentrated serum is to be preferred, and only that obtained from a reliable source should be used. It is unfortunate that legal restrictions do not make it impossible for any other to be sold. My own experience has been chiefly with the serum of Behring and that of the New York Health Department, both of which are absolutely reliable, as are also the serum of Mulford and that of Parke, Davis & Co.

Not only must a sufficient dose be given, but, to be efficient, the antitoxine must be administered early in the disease before the diphtheria toxines have done their work. The serum can not undo the serious damage already done to the cells of the body, and this at the time of injection may be so great that death will result. One who waits until his cases have grown alarmingly worse under other treatment and gives but half doses, will see little benefit from antitoxine. In very mild cases, with older children, one may wait for the result of a bacteriological examination where such examinations are possible, but never in a severe case and never in a young child. In the group of severe cases should be placed every one which at the first visit shows a pharyngeal exudate covering more than the tonsils, also all cases with symptoms of laryngeal invasion, and all with an exudate in the pharynx and a profuse nasal discharge. If in a doubtful case twelve hours' observation shows that the membrane has spread from its original seat, no further delay is admissible. Experiments have shown that after a fatal dose of diphtheria toxine, an animal can usually be rescued if the antitoxine is administered within forty-eight hours, but rarely after that time. In human diphtheria marked benefit usually follows injections made as late as the third day; but after three days have passed little benefit is to be expected, although it occasionally follows even later injections. On the other hand, in very severe or in malignant cases irreparable harm may be done by the disease during the first twenty-four hours.

The local effects of the injection are a slight redness, pain, and usually some transient œdema. General eruptions are seen in a considerable number of cases, from five to forty per cent according to various observers. They are most frequent from the eighth to the twelfth day after injection, usually appearing in the form of an urticaria. Although in most cases slight and transient, the body may be covered and the urticaria continue to be most annoying for several days. Various forms of erythema have been occasionally observed, and in a few cases swelling of the joints.

There appears to be a close connection bet serum administered and the occurrence of certainly much less frequent since the use toxine.

The effect upon the diphtheritic membran twenty-four hours; it first stops spreading, ar loosen. The swelling of the mucous memb disease abates, very much after the manner its usual course. The striking thing after rapidity with which these changes take plac from an advancing to a retrograde process. dence of the inflammatory conditions in the la marked as in the pharynx. The symptoms of often diminish in a few hours and continue to unnecessary in a very large number of cases inevitable. The membrane loosens rapidly sometimes necessitating the frequent remov where operation has been performed. It is t ton (Brooklyn), and of some other operators, quently coughed up after the use of antitoxi because of the rapid subsidence of the swel shown by the cessation of the nasal dischar nasal respiration, and the diminution in the the neck.

The effect upon the constitutional sympto favourable cases there is seen, often in twelve and improvement in the pulse and in the nerv Sometimes the change in the general symptom local conditions.

The limitations of antitoxine.—It is impo ways be kept in mind. The serum must be gi it can not undo the mischief already done by t of great severity have often passed the period before the antitoxine is given. This period days, in others it may be less than twelve ho ceptible to the diphtheria toxine are probably heart, and the kidneys; and the consequences the production of nephritis, in sudden heart f disease, or some form of post-diphtheritic par that antitoxine was given at a period early en local disease in the larynx or bronchi. Again, cases of streptococcus septicæmia. The early excited by the diphtheria bacillus is unfavoural coccus infection, yet sometimes the latter has of such intensity as to involve almost the entire body. Against the phlegmonous inflammation of the throat or the cellular tissue of the neck, broncho-pneumonia, and nephritis, antitoxine is powerless; and just in proportion to the severity of these inflammations are negative results seen.

Real and alleged dangers from antitoxine injections.—In the cases where sudden death has followed antitoxine injections, the evidence that antitoxine was the cause of death is not conclusive. That only three or four alleged instances of this have occurred among the hundreds of thousands of antitoxine injections which have now been made, is sufficient to establish the fact that the serum itself is harmless. These rare accidents have been attributed to the carbolic acid used to preserve the antitoxine, to the injection of air,* to the shock from needle puncture, and to individual idiosyncrasy.

Regarding the unfavourable effects upon the heart, the kidneys, and the blood, attributed to antitoxine, they are to my mind not proved. In a disease like diphtheria, where the heart and kidneys are so often and so seriously affected, and where cardiac and renal symptoms in so many cases are so suddenly manifested, it is impossible to say, even when such symptoms follow the injection of serum, that they are not due to the original disease. They were seen with great frequency before antitoxine was heard of. It is, however, not impossible that in a very young or delicate child the sudden introduction into the circulation of such a large quantity of horse-serum as was first used (i. e., 20 or 30 cubic centimetres) might intensify existing cardiac or renal disturbance—a result not probable and I think not reported with the concentrated serum now in use. Observations regarding the effect of the serum upon the blood were made by Billings, Jr., upon twenty-nine cases of diphtheria. He found the reduction both in the hæmoglobin and the red cells to be much less than the average found in cases of diphtheria of similar severity not treated by the serum.

At the present time, after the serum has been in general use for nearly two years, no evidence has been adduced as to its danger or injurious effects which should deter any one from its use. Those which have been reported are to be looked upon in the light of accidents for which the antitoxine was probably not responsible.

The results with antitoxine in hospital practice.—Guerard, in Bulletin No. 3 of the New York Health Department, has collected reports of 9,893 cases treated with the serum, with an average mortality of 18·3 per cent. Of these cases, 7,277, in which the mortality was 20 per cent, were returned by 53 hospitals; the reports from the same hospitals give as their previous mortality an average of 44·3 per cent. The accompanying chart

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* Seibert and Schwyzer, New York Medical Journal, May 30, 1896.

(Fig. 166) shows the results obtained in the Children's Hospital, Berlin, with and without the serum.

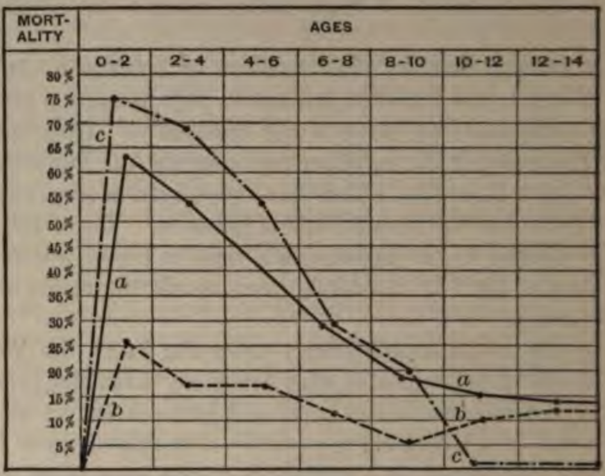

Fig. 166.—Chart showing the percentage mortality from diphtheria in the Children's Hospital, Berlin, for three periods: *a*, *a*, for four years before the introduction of the serum; *b*, *b*, for the first year of the serum treatment; *c*, *c*, for two months during that year when the supply of serum failed. (After Baginsky.)

The fact that during August and September of the first antitoxine year, when the supply of serum became exhausted, the death-rate rose at once to nearly three times what it had been, and fell again when the serum was again in use, is one of the most striking demonstrations yet published in favour of the serum. Identical experiences are reported by Korte, Heim, and Ganghofner, all showing that the results were not explained by a milder form of the disease, for when antitoxine was omitted the same mortality prevailed as had been formerly observed.

Results in private practice.—The largest number of cases from this source has been brought together in the Collective Investigation made by the American Pædiatric Society.* This embraces 5,794 returned by 615 physicians from 114 cities and towns in America, with an average mortality of 12·3 per cent. But in this report is included every case returned in which the serum was given, many of which were moribund at the time of injection, the serum being used only to gratify parents. If these cases and those dying within twenty-four hours after the first injection be excluded, there remain 5,576 cases, with a mortality of 8·8 per cent. Of 4,120 injected during the first three days the mortality was 7·3 per cent, or, excluding moribund cases and those dying twenty-four hours after the first injection, but 4·8 per cent. The diagnosis of diphtheria was confirmed by a bacteriological examination in 83 per cent of these cases; in the remainder it rested upon the clinical symptoms.

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* Archives of Pædiatrics, July, 1896.

Influence of the serum upon the diphtheria mortality in cities.—If Behring's antitoxine is the specific remedy for diphtheria that it is claimed to be, its general use should produce a decided fall in the actual mortality from diphtheria. We will take the figures from four large cities—New York, Berlin, Paris, and Chicago; from the first three we have full reports not only of the antitoxine period, but of several years preceding.

In the city of Paris, during the six years preceding the use of antitoxine (1889 to 1894 inclusive), the average number of deaths from diphtheria and croup was 1,518; the minimum number was 1,009, this being in 1894, during the last four months of which antitoxine was in general use. During the first year of antitoxine (1895) the number of deaths fell to 442, or considerably less than one half the mortality of any previous year during the period considered.

The following table gives the number of deaths per month for the first three months of the six years before, and the two years after the introduction of the serum:*

CITY.		Average monthly mortality, 1889-'94, without serum.	Minimum monthly mortality, same period.	1895. With serum.	1896. With serum.
Paris......	January............	160	120 (1892)	48	47
	February...........	152	108 (1893)	47	56
	March..............	180	148 (1894)	45	48
Berlin.....	January............	135	102 (1891)	79	58
	February...........	117	103 (1891)	64	54
	March..............	114	86 (1891)	88	47
New York (1894 only).	January............	317	....	207	181
	February...........	276	....	171	172
	March..............	236	....	168	165

The only month in which a lower mortality occurred without antitoxine than with it was in Berlin, in March, 1891; but it will be seen that the amount of diphtheria in the city that year was much less than the average, as is indicated by the figures for January and February.

The following chart (Fig. 167) shows even better than the table the influence of the introduction of antitoxine. Had the serum been employed to the same extent in all the cities, we should doubtless see a corresponding reduction in the number of deaths in all. But, as is well known, the serum was much more generally employed in Paris than in either of the other cities.

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* These figures are taken from the advance sheets of Bulletin No. 3 of the New York Health Department, placed at my disposal by Dr. H. M. Biggs.

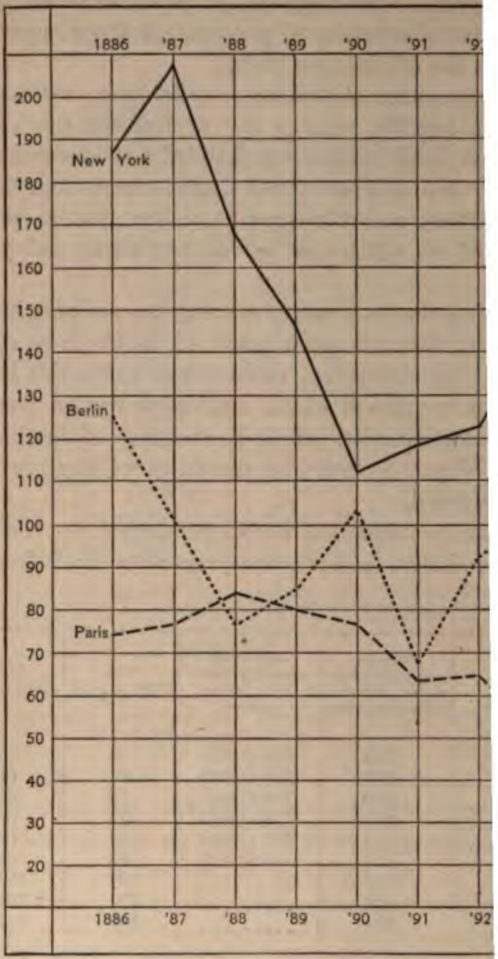

FIG. 167.—Chart showing deaths from diphtheria and crou
York, Berlin, and Paris. During the last half of 1894 a
and during the last four months of that year it was in ge
that the only time during the period when the lines of
the use of the antitoxine. (From Bulletin No. 3, New Y

The results in the city of Chicago are qu
Paris, and are shown by the accompanying ch
onstrates how a rapidly rising death-rate was
tion of the serum in October, 1895.

The lines for both years show a relatively s
ing the summer, but a rapid increase in the a
noted that during every month of the second
October, there was an increase in the fatal ca

and that in October the daily death-rate was 8·1 a day, as against 5·5 the previous year. The epidemic of diphtheria at this time had attained such proportions in the city that the question of closing all the public schools was considered. In the latter part of October the Health Department brought antitoxine into general use by establishing sixty stations throughout the city where it could be obtained, and organizing a special corps of physicians to visit the diphtheria cases. One of these was sent to every case in a tenement house, and the serum injected unless refused by the parents. The effect upon this daily death-rate is graphically shown in the chart. Of 1,468 cases treated by the inspectors, the mortality was but 6·4 per cent; and of 1,112 cases injected during the first three days, but 2·5 per cent.

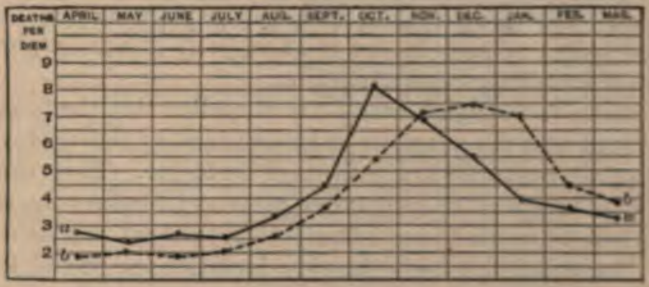

FIG. 168.—Showing the average daily mortality from diphtheria in Chicago for two years. The dotted line, *b*, *b*, indicates the mortality from April, 1894, to April, 1895; the line *a*, *a*, the mortality from April, 1895, to April, 1896. Antitoxine was introduced at the close of October. (From the Report of the Chicago Health Department.)

Results in other American cities have been no less striking. In the city of Newark, N. J., there were reported to the Board of Health, from June 20, 1895, to March 20, 1896, 939 cases of diphtheria; 606 of these were treated by the serum, with 85 deaths, a mortality of 14 per cent; 333 cases did not receive the serum, and among these there were 138 deaths, a mortality of 41·4.

In the city of Boston, Ernst reports 1,156 cases treated by the serum, with 165 deaths, a mortality of 14·2 per cent. The report by MacCullom from the diphtheria wards of the Boston City Hospital shows even better results. Of 844 cases treated by the serum, there were 96 deaths, a mortality of 11 per cent; the previous mortality in the same institution without serum was 40 per cent.

The results as modified by the time of injection and the age of the patients.—The statement has been already made that striking improvement from the use of the serum is seen only when it is used early. In the American Pædiatric Society's report the mortality of 4,120 cases injected during the first three days was 7·3 per cent, including even those which were moribund at the time of injection; of 758 cases in-

jected on the fourth day the mortality was
injected later than the fourth day it was
are from private practice. The statistics fro
approximately the same variation, but the
higher.

It has been the experience of nearly every
tion in mortality is seen in the youngest pa
the mortality of 867 cases two years old an
while, excluding moribund cases and those dy
of the first injection, it was only 19·2 per cent
this great reduction from former figures. T
whom often little or nothing could be done
whom broncho-pneumonia was almost certai
the larynx. The serum enables us largely
ment, and when used early in the great majo
extension of membrane below the larynx.

The results in laryngeal cases.—The alleg
sults obtained with the serum are to be explai
disease can not be applied to diphtheria of the
mild, nor do they tend to spontaneous recove
obtained both by intubation and tracheotomy
known. Laryngeal diphtheria therefore furni
serum treatment. The benefits of the serum
ber of cases that recover without operation;
of recoveries in operative cases; thirdly, in th
the tube is necessary.

It is not yet possible to give exact figur
of laryngeal cases that recover without opera
during the two months in which the serum tr
the Childrens' Hospital in Berlin, because th
proportion of cases requiring operation was 5
serum, during the period immediately prece
was only 18·1 per cent. This is to be explaine
the early use of the antitoxine the larynx less
and partly by the number of laryngeal cases
tion.

In the Pædiatric Society's report there w
which 554 recovered without operation. Wel
from seven European observers with reference
report in 401 laryngeal cases, 27·2 per cent o
tion. The improvement in the results of op
striking:

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* Transactions of the Association of Ameri

Results from Intubation with and without Antitoxine.

Source.	Cases.	Mortality.	
Ranke, European hospitals	1,445	62·5	Without antitoxine.
Welch, European hospitals	342	29·8	With "
McNaughton and Maddren, private practice in America	5,346	69·4	Without "
American Pædiatric Society's Report, private practice in America	533	25·9	With "
Dillon Brown, private practice, with calomel fumigations	279	49·4	Without "
Reports of operators with experience of 10 cases or more, in American Pædiatric Society's Report	280	23·2	With "

O'Dwyer says of his last 100 operations, that the first 70 without the serum gave a mortality of 73 per cent, the last 30 with the serum a mortality of 33·3 per cent. McNaughton says that in his last 72 operations without serum the mortality was 66·6 per cent; the first 72 with serum, 33·3 per cent.

It is useless to multiply evidence, for from all parts of the world the testimony is the same, that the mortality in cases of laryngeal diphtheria requiring operation has been reduced at least one half by the introduction of serum. This marked improvement is due to two causes: the serum shortens very materially the length of time it is necessary to wear the tube; and, what is far more important, it prevents the extension of the membrane downward into the trachea and bronchi, in this way removing in great measure the danger of broncho-pneumonia.

The results from tracheotomy have likewise been greatly improved by the serum, although not to the same degree as those from intubation. A collection of 23,941 tracheotomies for croup by Prescott and Goodthwait * gives a mortality of 71·3 per cent. Of 873 tracheotomies with serum † the mortality was 40·9 per cent. It is now generally conceded, not only in America but all over the continent of Europe, that as a primary operation intubation should always be performed, tracheotomy being reserved for the rare cases in which intubation has failed to relieve the stenosis.

Summary.—1. Behring's antitoxine is a specific remedy for experimental diphtheria in animals.

2. Experience is now sufficient to justify the statement that it is so in man, and just in the degree to which we can fulfil the conditions which are essential in experimental diphtheria.

3. These conditions are, that the serum must be administered early—usually within forty-eight and certainly within seventy-two hours—that the dose be adequate, and the case be one of pure diphtheria.

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* Gillet, Séro-thérapie, Paris, 1895.

† Guerard's collection, in New York Health Board Bulletin.

4. Experience shows the serum to be mu
so-called mixed infection or septic diphtheri
membranous inflammations which are due
diphtheria.

5. The serum itself is essentially harm
healthy persons for immunization, or in th
Serious symptoms following injections are
must be attributed to other causes.

6. Unpleasant symptoms, rashes, etc., h
volume of serum injected, and with the co
available they have become much less freque

7. In a young child the serum should be i
nosis of diphtheria without waiting for a bac

8. In older children one may wait for thi
a severe one, particularly a laryngeal case.

9. For all cases, but especially for youn
trated preparation of antitoxine which can be

10. From the most trustworthy statistics
appears that the actual mortality from dipht
croup) has been reduced at least one half b
serum treatment; and

11. That in cases injected during the fi
less than five per cent.

12. The evidence is conclusive that in la
in sufficient doses largely prevents the exte
trachea and bronchi, and thus prevents bronc

13. There are not yet sufficient data at h
what degree the heart, the kidneys, and the
by the serum. It is, however, certain, that
nervous system, the injection must be made v

14. While much still remains to be learn
present knowledge justifies the statement that
a month—the protection conferred is practic
doses should therefore be given to every child
institution.

15. Gratifying as were the earlier results
they have been constantly improving, and the
that, with larger experience both in its prepar
results will yet be reached. Certainly there
that has more testimony in its favour than
theria.

Other treatment in connection with anti
nothing else is required except to keep the ch
fluid diet. In the severe cases, heart stimul

strychnine, are to be used as formerly, according to the condition of the pulse. Nasal injections of bland fluids, either a warm salt solution or five-per-cent boric acid, should be used every three or four hours in severe nasal or naso-pharyngeal cases, unless the child is very young or intractable, but if he struggles much against them more harm than good is likely to result from their continuance. The mouth should be kept clean by the use of an antiseptic mouth-wash, such as Seiler's solution, or, in the case of older children, by a gargle of bichloride 1 to 10,000. A fluid diet, careful nursing, and absolute quiet are the only other measures that can be regarded as essential. The use of strong antiseptic or caustic applications, whether by the spray, swab, or syringe, for the purpose of controlling the local disease, should be entirely omitted. The heart and the kidneys should be watched in all cases, not only during the disease but for some time after it.

Convalescence.—After a severe attack of diphtheria convalescence is always slow on account of the anæmia and the depressing effects of the disease. Patients should invariably be kept in bed for at least a week after the throat has cleared, and longer if any tendency to cardiac weakness is seen. The pulse should be carefully watched, and irregularity, intermission, dicrotism, or a weak first sound of the heart, should make one apprehensive. An abnormally slow pulse may be more serious than one which is rapid. Under such circumstances the patient should be kept recumbent and absolutely quiet, since sudden and even fatal syncope may be the result of the violation of these rules.

The extreme degree of anæmia requires that iron be given for a considerable time during convalescence, to be followed by cod-liver oil, wine, and other tonics.

Great difficulty is occasionally experienced in getting rid of the bacilli in the throat. Inasmuch as it is now generally made a condition of release from quarantine that the throat shall have been shown by cultures to be free from bacilli, this becomes a matter of much importance. The tonsillar crypts and the adenoid tissue of the rhino-pharynx are the places where bacilli are likely to remain. The most efficient means appears to be, to syringe the nose four or five times daily with a solution of bichloride, 1 to 5,000, to which one eighth glycerin has been added, and to use the same solution as a gargle. For children under four years old a simple salt solution, or a dilute Dobell's solution, should be substituted and the gargle omitted.

PSEUDO-DIPHTHERIA.

Synonyms: False diphtheria, streptococcus diphtheria, scarlatinal diphtheria, diphtheroid inflammation, croupous tonsillitis.

At the present time there are included under the term pseudo-diphtheria all inflammations of the throat and upper air passages characterized by the production of a false membrane, in which the Loeffler bacillus is not found. When these inflammations are primary they are rarely serious; but when they complicate scarlet fever or measles they may be very severe, and frequently prove fatal.

Frequency.—Numerical statements regarding the relative frequency of this disease and true diphtheria signify very little, because of the variable conditions under which observations have been made. From the investigations of Park, Baginsky, Martin, Morse, and others, it would appear that in from twenty-five to thirty-five per cent of the cases formerly sent to hospitals with a clinical diagnosis of diphtheria, the disease was pseudo-diphtheria. Most of these were mild, and were then regarded by many physicians as simply cases of tonsillitis, the exceptions being those which were secondary to scarlet fever or measles.

Of the membranous inflammations occurring in the diseases just mentioned, the great majority are examples of pseudo-diphtheria. Of seven cases of membranous angina in measles and three in scarlet fever, studied by Prudden, all were proven to be pseudo-diphtheria; of nineteen occurring with scarlatina, studied by Park, only two were found to be true diphtheria; and of sixteen occurring with scarlet fever and three with measles, studied by Booker, none were true diphtheria. The observations made along the same lines by Sorenson, Wurtz and Bourges and others have confirmed the results obtained upon this side of the Atlantic. It has been the general experience of all writers that when it complicates the diseases mentioned, pseudo-diphtheria occurs, as a rule, at the height of the primary disease, sometimes preceding the eruption, while true diphtheria more often occurs later, even during convalescence.

Etiology.—As was first shown by Prudden in 1888, and abundantly confirmed by others since that time, this inflammation is usually due to the streptococcus pyogenes; it may be found alone, or associated with the staphylococcus aureus or albus, and occasionally the staphylococcus may be found alone.

The streptococcus is very frequently found in the throats of healthy persons, particularly at certain seasons in cities, and in children who live in tenements or who are inmates of hospitals or other institutions. The local conditions in the mucous membranes during an attack of measles, scarlet fever, and other infectious diseases, are especially favourable for the development of these germs, which at such times are very often present in great numbers even when no membrane is seen.

Bad drainage and sewer-gas poisoning are other conditions with which this form of sore throat often exists, and a predisposition is afforded by unhygienic surroundings of any description. From the fact that the streptococcus is so widely distributed, attacks of pseudo-diphtheria may occur in any place and at any time, irrespective of epidemic influences or even the occurrence of other cases.

To what degree these cases are to be regarded as communicable, and what precautions regarding isolation and disinfection are required, are questions of much importance. The most extensive investigations upon these points are those made by the New York Health Department.* As a result of observations upon 450 cases which were followed, the conclusion was reached that the disease was so slightly contagious (if at all), and usually so mild, that strict isolation and subsequent disinfection were unnecessary. Of 113 cases occurring in 100 families, in only 14 was there a history of exposure to a similar case; and in only 9 was there another case in the same family. In many of the latter, a common origin appeared more probable than that one case was derived from another.

At the present time the general opinion of the profession seems to be that these cases are to a slight degree communicable, to be compared in this respect to ordinary catarrhal colds or possibly to pneumonia. They are probably more contagious in the presence of the poison of scarlet fever or measles.

Lesions.—In the primary cases the membrane is generally confined to the tonsils or is chiefly there, there being only small deposits elsewhere. In the secondary cases, the entire pharynx may be covered and the disease may extend to the nose, the mouth, the middle ear, and occasionally to the larynx, trachea, and bronchi.

The structure of the membrane resembles that of true diphtheria, and it is impossible by a microscopical examination alone always to separate the two diseases. In many cases the membrane is softer, more friable, and contains a relatively larger number of cells than does that of true diphtheria, but the structure of the latter varies so much that it is not safe to draw any positive conclusions.

In the mild cases the inflammation of the mucous membrane is a superficial one and the false membrane is not very adherent. In the severe cases, chiefly the secondary ones, the process extends much deeper. There are usually seen only congestion, œdema, and cell infiltration, but deep suppuration, and even extensive necrosis may take place. This usually occurs in the tonsils, palate, uvula, or epiglottis; but it may extend to the tissues of the pharynx and into the cellular tissue of the neck. The

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* Scientific Bulletin, No. 1.

lymph nodes are swollen in all the severe cas
tion ends in suppuration.

The streptococci are found in the false n
mucous membrane, in the lymph spaces and
most severe cases there are present the lesion
infection. The blood swarms with these ge
flammations in any of the organs, but espe
kidneys, less frequently the serous membran
tion may be found in any of the viscera.

Symptoms.—1. *The primary cases.*—The
well-marked symptoms: there are frequently
vomiting, general pains, and in most cases th
of the throat and pain on swallowing. There
ness and swelling of the tonsils, sometimes of
afterward membranous patches appear upo
greatly in appearance. In colour they are ye
later to a dirty-olive tint. (Plate XVII, c.)
ly attached and can frequently be wiped off
friable, very rarely thick, firm, or tenacious.
outline, which is not sharply defined. The
but three or four days and disappears rapidly.
the tonsils, and does not spread after it first
ever, small patches are also seen upon the fa
œdema and other evidences of inflammatio
more marked than in true diphtheria, and
nodes behind the jaw is slight. The constitu
ally more severe during the first two days, a
103° or 104° F., but by the third day it falls,
subside. It is rare for the disease to extend
larynx. Generally there are no complications

2. *The secondary cases.*—Some of these a
from those just described, but most of the seve
group. The clinical picture of the latter is t
as given by the older writers, and it does not
ticulars from the septic form of true diphth
symptoms are those of severe pharyngeal di
tional symptoms those of septicæmia.

When the disease complicates scarlet fever,
the eruption, but they usually begin at the heigh
from the second to the fourth day—and gra
reaching their maximum from the fifth to th
In measles the throat symptoms are somewha
height of the primary fever, and often increas
In nearly all severe scarlatinal cases the diseas

middle ear. In measles both these complications are less frequent, but there is a much greater tendency to involve the larynx, and if the larynx in a young child the process is almost invariably complicated by broncho-pneumonia. In some cases the larynx is invaded when there is no membrane in the pharynx; but this is very infrequent, unless the disease is true diphtheria. Catarrhal laryngitis in a young child may produce symptoms which are practically identical with those of the membranous form, and there is little doubt that many cases complicating measles in which the latter diagnosis is made are really examples of catarrhal laryngitis, particularly if no membrane is visible in the throat.

Secondary cases as a class are characterized by high temperature (Fig. 169), rapid, feeble pulse, great prostration, and delirium, apathy or stupor, and often albuminúria. In fatal cases death usually occurs at the height of the disease, from asthenia, broncho-pneumonia, or nephritis, sometimes from laryngitis. If none of these complications develop, patients may withstand the toxic symptoms even when they are very severe. If the attack terminates in recovery, the local disease follows very much the same course as in diphtheria. The subsequent anæmia is, however, less severe, and none of the dangers of convalescence connected with cardiac or respiratory paralysis are present.

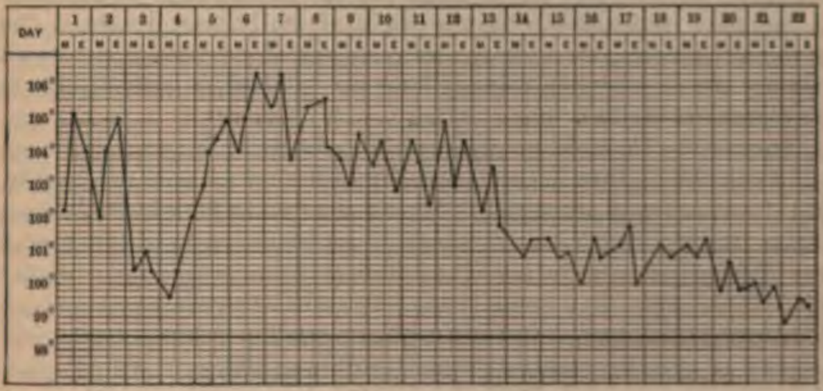

FIG. 169.—Pseudo-diphtheria following measles. The chart begins at the time of the full eruption in a severe case of measles. On third day temperature fell, with fading eruption, and child seemed convalescent. With secondary rise in temperature, the tonsils, which before had been only red, showed membranous patches, the exudation rapidly spreading until the entire pharynx was covered; throat symptoms very severe, with great swelling of cervical glands, but the membrane did not extend beyond the pharynx. From sixth to twelfth day a most profound septicæmia, so that life was despaired of. The patient was a vigorous child, and, escaping both nephritis and pneumonia, made a good recovery. Convalescence quite rapid; no sequelæ. Repeated cultures were made from the throat, but all showed only streptococci. Patient a girl four years old. Case observed in private practice.

There may be in connection with the local process in the throat, deep sloughing of the tonsils or adjacent structures, suppuration of the lym-

phatic glands or in the cellular tissue of the n
serious hæmorrhage. However, all these com
patient survives the danger of the acute sta
recovers.

Diagnosis.—The clinical features which d
from true diphtheria have already been consi
possible in any case to be certain of the diagn
although by clinical symptoms alone one m
cases be certain that a given case is one of tru
membranous inflammation of the throat is r
The bacteriologists have taught us to be ca
positively upon even the mild cases, as it h
some of them may be caused by the most vi
(page 965).

In the secondary cases the diagnosis by
accurate. A membrane which appears in th
of measles or scarlet fever, or at the height of
to the streptococcus in at least four cases o
develops late or after the primary fever has
the diphtheria bacillus.

Prognosis.—There is no more striking
pseudo-diphtheria than in their mortality whe
Of 117 primary cases of pseudo-diphtheria obs
Parker Hospital, New York, the mortality was
true diphtheria seen in the same institution at
was 34·5 per cent. In a group of 154 hospital
there were 118 of true diphtheria, with a mo
34 cases of primary pseudo-diphtheria, with
From the same hospital, Philip has publishe
332 of these were true diphtheria, with a mort
cases of primary pseudo-diphtheria, with no
the New York Health Department contains
pseudo-diphtheria in children, with a mortalit
the fatal cases complicated scarlet fever; of t
tality was but 1·5 per cent. These were not
is very seldom involved in primary cases, ar
nearly always recover. From the above data
ranted that in a child previously healthy, pr
not a serious disease.

Turning now to the secondary cases, we fi
things. Large statistics are not yet availab
published it would appear that the usual mor
when it is secondary to scarlet fever and measl
However, when these diseases prevail epiden

young children, the mortality not infrequently reaches 70 or 80 per cent. Under such conditions the cases complicating measles give, as a rule, a higher mortality than those complicating scarlet fever.

Prophylaxis.—In primary cases strict quarantine is unnecessary after the question of diagnosis has been settled. However, in private practice, healthy children should be excluded from the sick-room during acute symptoms. Cases of pseudo-diphtheria occurring in measles or scarlet fever should certainly be separated from uncomplicated cases. By way of prevention, something can be done in these diseases by keeping both nose and throat as clean as possible during every severe attack, by the use of an antiseptic mouth-wash or gargle, and by a nasal spray or even nasal syringing. For young children only weak solutions should be employed, such as a diluted Dobell's or Seiler's solution, 1 : 10,000 bichloride, or a one-per-cent solution of boric acid. For those who are older, stronger solutions may be used, especially as a gargle.

Treatment.—Every child with a membranous patch on its throat requires close watching. If the child is young—i. e., under ten years old—the diphtheria antitoxine should be administered, pending the result of a bacteriological examination. The primary cases require only the treatment of attack of tonsillitis; the child should be put to bed, the bowels freely opened, and the diet should be light and fluid. If old enough he should gargle five or six times a day with some one of the solutions mentioned above; but with younger children it is not worth while to persist in any attempts at local treatment, unless the case is manifestly progressing unfavourably, when the treatment should be the same as in the secondary cases.

The occurrence of a patch upon the tonsil of a child with scarlet fever or measles should be the signal for beginning active local treatment. If the child is old enough so that it can be done without force, the tonsils should be touched three times a day with a solution of bichloride, 1 : 500, with a swab, and a gargle should be used every hour during the day, of 1 : 5,000 bichloride, or a saturated solution of boric acid. If there is a nasal discharge, the nose should be syringed with a bland solution, as in true diphtheria (page 987). In a younger child forcible swabbing is a very doubtful expedient. It is usually better to content one's self with syringing both the nose and the mouth with bland solutions. The frequency with which these measures are used will depend upon the severity of the case. The treatment of these cases by the "streptococcus antitoxine" has not yet reached a point where it is to be recommended.

In the general management of these cases, feeding, stimulants, etc., the same plan is to be followed as in diphtheria.

CHAPTER IX.

TYPHOID FEVER.

Typhoid fever is an acute infectious disease due to a specific germ—Eberth's bacillus—which is abundantly present in the intestinal discharges of affected persons. It is very rare in infancy, but is not infrequent in childhood. As compared with the same disease in adults, the typhoid of childhood is characterized by its shorter duration, milder course, the infrequency of serious complications, and its low mortality.

Etiology.—*Age.*—I have never seen typhoid fever in a child under two years old, and I believe it to be very rare, although undoubted cases have been reported even during the first year. Murchison records one only six months old, and Ogle another four and a half months old, the diagnosis being confirmed by autopsy in both instances. No case of typhoid was seen in the New York Infant Asylum during my eight years' service there, about ten thousand cases of illness having been treated during the period, and over seven hundred autopsies made. In seven years but one case was admitted to the Babies' Hospital, this being in a child over two years old. In over two thousand autopsies—chiefly upon children under two years old—made at the New York Foundling Asylum, Northrup did not meet with a single case of typhoid, nor was one known to have occurred in that institution for twenty years. The exceptional cases in infancy have almost invariably been observed in general epidemics. In an epidemic in Montclair, N. J., in 1894, 115 persons were attacked, 3 of these being under two years old. In a severe epidemic in Stamford, Conn., in 1895, 406 persons were attacked, 4 being children under two years old.

After the second year typhoid is by no means rare, but it is not until after the fifth year that it can be said to occur frequently. The following figures, embracing groups of cases reported by eight writers, represent perhaps as well as statistics can the relative frequency with which the disease is seen at the different ages: Of 970 cases, 8 per cent occurred under five years, 42 per cent between five and ten years, and 50 per cent between ten and fifteen years.

Typhoid is almost invariably contracted by drinking water or milk which contains the germs of the disease. It is not within the scope of this article to discuss the manifold ways in which this may occur. The epidemics of Montclair and Stamford, already referred to, were definitely traced to infected milk. The infrequency of typhoid in infants is explained, in part at least, by the fact that most of the water and a large part of the milk taken have previously been boiled, or at least heated. In cases where the period of incubation could be determined with something approaching accuracy, this has varied between five days and three weeks.

Lesions.—Typhoid in young children is so seldom fatal that opportunities for a study of the lesions have been limited. In a general way the lesions resemble those of adults except in severity. There is acute swelling of Peyer's patches, especially in the lower ileum, and of the solitary follicles of the small intestine and the colon, which may be followed by ulceration. There are frequently present the evidences of a mild catarrhal enteritis. The mesenteric glands are swollen and the spleen is enlarged and soft.

The intestinal lesions are, as a rule, much less severe than in adults; in a considerable number of the cases this process does not go on to ulceration; and when ulcers form they are seldom large or deep, and perforation is very rare. Montmollin gives the following facts concerning 23 autopsies, most of them, however, being in children over eight years old: ulcers were present in 17 cases; they were situated in the lower ileum in 16, and in 10 they were only there; in the ascending colon in 9, and only there in one case; in one other case they were in the transverse colon, and in another they extended to the sigmoid flexure; perforation occurred in 3 cases, in every instance in the lower ileum. In 25 autopsies by Reimer, ulcers were noted in 20, and in 2 there was perforation. The autopsies made upon young children show even less severe intestinal lesions than those mentioned. In fact, some cases in which the clinical diagnosis was beyond question, have shown only moderate redness and swelling of Peyer's patches, the solitary follicles and the mesenteric lymph nodes,—lesions which are exceedingly frequent in cases of simple diarrhœa, as my own experience has abundantly demonstrated. It should be emphasized that in a doubtful case such post-mortem findings do not establish the diagnosis of typhoid. Indeed, they prove nothing unless cultures from the intestinal contents, the mesenteric glands, or other organs, show the typhoid bacillus. From a consideration of the clinical course of the disease, it seems very probable that in a large proportion of the cases which recover, ulceration does not take place. Enlargement of the spleen is practically constant. The degenerative changes in the heart, the kidneys, and the liver are much less frequent and generally less severe than in adults. The lesions of other organs will be considered under Complications.

Symptoms.—The peculiar features of typhoid in early life are seen only in children under ten years old; for after this time the disease does not differ essentially from the adult type. In brief, the typhoid of early childhood may be characterized as a fever more often with nervous symptoms, than with intestinal symptoms.

Onset.—A sudden onset with well-marked symptoms—fever, prostration, vomiting, etc.—is not uncommon; in fact, it is quite as frequently seen as the insidious beginning with lassitude, headache, coated tongue, anorexia, and gradual rise in temperature. In cases developing abruptly it often appears as if an acute indigestion had been the means of precipitating the attack. The most frequent initial symptom is vomiting; a chill is rare. I have once known the disease to be ushered in by convulsions, but this is very exceptional. Epistaxis occurs as an early symptom rather less frequently than in adults.

Condition of the bowels.—There is no constant relation between the severity of the intestinal lesions and the condition of the bowels. Taking large groups of cases together, diarrhœa is present in about half the number. Morse's * observations, however, upon children under ten years old showed that constipation was present in two thirds, and diarrhœa in only one third of the cases. The diarrhœa is rarely profuse, from two to four discharges a day being the average. The appearance of the stools is seldom characteristic; they are usually thin and fluid, often containing mucus. Constipation may be present at the beginning only, or it may persist throughout the attack. Tympanites is generally moderate in degree, and is often entirely absent; it usually accompanies constipation. Marked iliac tenderness and gurgling are infrequent.

Spleen.—By the end of the first week this is almost invariably found to be enlarged to a sufficient degree to be recognised by palpation (page 832), unless a satisfactory examination can not be made owing to the presence of tympanites or the extreme irritability of the child. Usually the spleen extends but an inch or an inch and a half below the ribs, but at times it may be three inches or more. Swelling of the spleen is an important symptom not only for diagnosis, but also for prognosis; its persistence always indicates that the disease is not at an end even though the temperature has reached the normal, and a relapse should be expected.

Eruption.—It is the experience of nearly all who have seen much of typhoid in children that the eruption is less constant, less abundant, and less characteristic than in adults. Of 670 cases in Morse's collection, it was noted in but 60 per cent. The typical eruption consists of small, scattered, rose-coloured spots, which appear chiefly or solely upon the abdomen at the beginning of the second week. They come in successive crops, each one of which generally lasts three days, the whole duration of the eruption being about a week. The eruption reappears in most cases in which relapses occur.

Prostration, emaciation, etc.—As a rule the prostration is quite sufficient to keep a child in bed after the first few days. The general weakness after this time is in direct proportion to the height of the temperature. Loss of flesh is steady and usually marked; and in a prolonged attack there is marked emaciation.

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* Typhoid Fever in Childhood, with an Analysis of 284 Cases; Boston Medical and Surgical Journal, February 27, 1896. In this article, to which I am indebted for many statistics, will be found quite a full bibliography of the subject.

Temperature.—In the cases with a gradual onset, the typical temperature curve is one which rises steadily for from two to seven days, fluctuates within the limits of one to three degrees during the second week, and steadily declines during the third week, reaching the normal on the average at the end of the third week. In cases with an abrupt onset, the temperature rises at once to from 102·5° to 105° F., but subsequently may run the same course as in the first group.

The following are the most important variations from the temperature curve of adults: The initial rise is much more frequently rapid; during the second week the remittent character is less marked, this probably depending upon the fact that ulceration is less frequent and less extensive; the average duration is shorter. In young children the proportion of cases in which the fever lasts only from eight to fourteen days is quite large (Fig. 170). In Wolberg's* 277 cases, the duration of the fever was fourteen days, or less in 70 per cent of the cases, and eight days or less in 2·8 per cent. Of this series, 60 per cent of the children were eight years old or under. In a series of 295 cases reported by Montmollin, most of which were in children over eight years old, the disease lasted over three weeks in 30 per cent. The same peculiarity is brought out by Morse's figures: not counting relapses, the average duration of 75 cases under ten years old was 19·3 days; of 202 cases from ten to fifteen years old, it was 22·6 days. After the age of ten years the type of the fever is much like that seen in adults. The maximum temperature in the mild cases is 103° or 104° F.; in the severe ones it often reaches 105° or 106° F., but rarely goes above this point. The range is usually higher than in adult cases of the same severity. Typhoid is about the only disease where the temperature runs higher in older than in younger children. At the beginning of convalescence a subnormal temperature is very frequent, and by many writers is considered to be the rule. A secondary rise is most frequently due to errors in diet, but may occur from the development of complica-

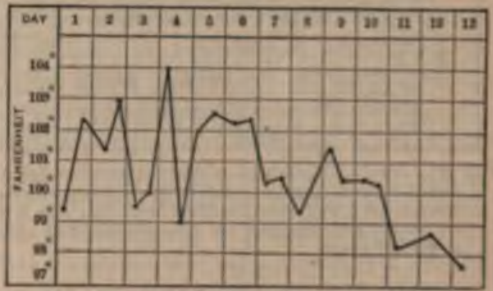

FIG. 170.—Typhoid fever of short duration in a child thirteen months old. Spleen enlarged; eruption typical; no diarrhœa and only moderate abdominal distention. There were two other cases in the family, all being due to the same cause—infected milk. (After Northrup.)

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* Jahrbuch für Kinderheilkunde, Bd. xxvii, S. 28.

tions. A sudden fall indicates either perforation or intestinal hæmorrhage.

Relapses are not infrequent; they were present in 11 per cent of 284 cases reported by Morse, and in 8·4 per cent of 533 cases collected by him. They follow about the same course as in adults. The interval between the attacks varies from two days to two weeks. The relapse is usually shorter than the primary fever, but is characterized by a reappearance of the eruption and most of the previous symptoms (Fig. 171).

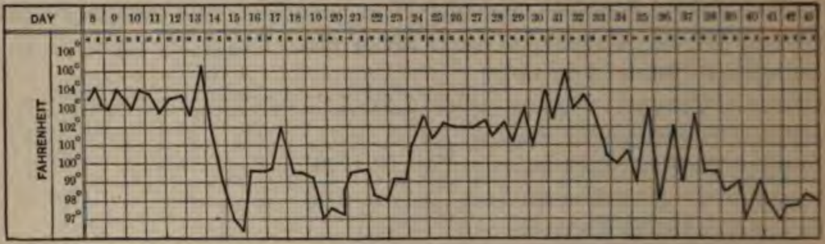

FIG. 171.—Typhoid fever with relapse. Child two and a half years old; early temperature high and symptoms typical; natural fall on fourteenth day; rise on seventeenth day apparently due to otitis; relapse on twenty-fourth day, with fresh eruption and return of splenic swelling which had disappeared. Temperature was subnormal at the end both of primary and secondary fever.

Nervous symptoms.—As a rule, these are more prominent in severe cases than the intestinal symptoms, and are directly proportionate to the height of the temperature. The extreme nervous symptoms belonging to the typhoid state in adults—subsultus tendinum, carphologia, and coma vigil, with the dry glazed tongue, etc.—are rare in childhood, and when present are generally in patients over ten years old. Headache and mild delirium at night are very frequent, the former being seen in the majority of cases. Young children are usually dull, apathetic, and often in a state of semi-stupor. Occasionally the disease may closely simulate meningitis. There may be general hyperæsthesia, delirium or stupor, opisthotonus, contracted or unequal pupils and strabismus; but very seldom convulsions. The nervous symptoms are usually most severe in the second, or early in the third week, and subside as the temperature declines.

Pulse.—This is increased in frequency, but not to the degree that is seen in most diseases of childhood with a similar elevation of temperature. The force and rhythm of the pulse are usually good, irregularity, very low tension, and dicrotism being rare as compared with adults; they may occur either at the height of the disease or during convalescence. Functional heart murmurs are quite frequent.

Intestinal hæmorrhage.—Of 946 collected cases, mainly from hospital reports, intestinal hæmorrhage occurred in 30, or about three per cent; the majority of these were in children over ten years old. Thus Morse reports that in 77 cases under ten years old there was no case of hæmorrhage; while in 204 cases between ten and fifteen years it was seen in 9 cases. The most frequent time of its occurrence is toward the end of the second week. Montmollin reports 14 cases of hæmorrhage, with 4 deaths; in Morse's 9 cases there were 5 deaths.

Intestinal perforation.—This is even more rare than hæmorrhage. In 1,028 collected cases, this accident occurred but twelve times, or in 1·1 per cent. Eight of these proved fatal. Perforation is indicated by a sudden fall in the temperature, with collapse; usually there is vomiting and the rapid development of tympanites. The infrequency of both perforation and hæmorrhage is explained by the superficial character of the intestinal lesions and the absence of deep ulceration.

Complications and Sequelæ.—The complications of typhoid in early life are infrequent and usually mild. Bronchitis is present in most of the severe cases. Pneumonia was noted in 9 per cent of seven hundred cases, reported by various authors. Both serous and purulent effusions into the chest are occasionally seen, and less frequently abscess of the lung. Gangrene of the lung, and severe inflammation or ulceration of the larynx are extremely rare.

A small amount of albumin is found in the urine in most of the severe cases at the height of the disease, but a marked degree of nephritis is infrequent. It was seen but three times in 295 cases reported by Montmollin.

Complications referable to the nervous system are not very frequent, but are of much interest. Meningitis is extremely rare. Morse has collected twenty-one cases of aphasia, in two of which it was clearly due to embolism; in the remainder, however, it apparently was not dependent upon any organic lesion. In two thirds of the cases it came on during convalescence, and in nearly all complete recovery occurred after an average duration of three weeks. Aphasia usually followed a severe type of the disease, and in most of the cases was not accompanied by any other paralysis or by mental disturbance. Insanity is a rare sequel of typhoid in children, the usual type being acute mania. Adams (Washington) has recently reported two examples of this, both terminating in recovery. Chorea is not an infrequent sequel, and is seen rather oftener than after the other infectious diseases. In most of the series of reported cases no mention is made of multiple neuritis as a sequel of typhoid, but it is certainly not very rare.

Otitis is not an infrequent complication, occurring much oftener than in adults. It is principally seen in young children and during the cold season. Among the less frequent complications may be mentioned: parotitis, which is usually suppurative and is seen in septic cases; abscess of the liver, examples of which have been reported by Bokai, Asch, and others; gangrenous inflammation of the mouth or genitals; pericarditis, endocarditis, and peritonitis, suppurative inflammations of joints, multiple abscesses and furunculosis. Tuberculosis of the lungs or bones not infrequently follows typhoid.

Diagnosis.—The diagnostic symptoms of typhoid are the continuous fever, the eruption, tympanites, and enlargement of the spleen. Unless the first two are present the case must be regarded as doubtful. One should be very slow to make the diagnosis of typhoid in a child under three years old, unless the disease is epidemic. The great proportion of sporadic cases reported as occurring in infancy are probably not typhoid. After the fifth year the disease is more frequent, and its symptoms in general resemble those of adults, except in severity.

The differential diagnosis is to be made from malarial fever, ileo-colitis, meningitis, tuberculosis, and from other ill-defined continuous fevers of unknown origin. From malarial fever the diagnosis is to be made by the temperature curve, the plasmodium in the blood, and the effect of quinine. In most of the cases of malaria the temperature will be found to touch the normal at some time in the twenty-four hours. While the presence of the plasmodium in the blood is conclusive, its absence is not so. The administration of full doses of quinine is a diagnostic test of much practical importance; an irregular or remittent fever which yields promptly to quinine is most certainly not typhoid.

Ileo-colitis and typhoid fever are not often confounded. The former is almost limited to the first three years of life, a time when typhoid is extremely rare. The intestinal symptoms of ileo-colitis are marked even though the temperature is not high, and they are altogether more severe than is usual in typhoid; while enlargement of the spleen, tympanites, and the eruption are not present.

The cerebral symptoms of typhoid may be difficult to distinguish from meningitis, unless one has watched their development. Irregular respiration, a slow, irregular pulse, localized paralysis and complete coma are seldom, if ever, seen in typhoid, and a retracted abdomen very rarely, while the enlarged spleen and the peculiar eruption are not seen in meningitis. In typhoid with pronounced nervous symptoms the temperature is usually higher than in meningitis.

General tuberculosis very often resembles typhoid so closely that a differential diagnosis is almost impossible until local signs of tuberculosis have appeared, usually in the lungs. (See page 1036.)

Widal's serum-test.—This consists in the "clumping" and immobilizing of typhoid bacilli in broth cultures, caused by the blood serum of a person sick with typhoid fever. This blood test, although but recently introduced, has already been shown to possess great value in making the diagnosis of typhoid, the characteristic reaction being obtained after the first week in the great majority of cases of this disease. As it has been found, although very exceptionally, in other conditions, it can not be regarded as an infallible test. (See Biggs and Park, Amer. Jour. of the

Med. Sci., March, 1897; also, Brannan, N. Y. Med. Jour., March 27, 1897, for a full discussion of the subject, with references to the recent literature.)

Prognosis.—Of 2,623 cases collected from the reports of twelve different writers, the mortality was 5.4 per cent. These are, however, almost all taken from hospital reports, where as a rule the mildest cases are not brought for treatment. The mortality of the disease in children, including all cases, probably does not exceed 3 or 4 per cent. Death seldom occurs from the disease itself, but usually from some accident or complication; the most frequent causes of death are pneumonia and intestinal hæmorrhage or perforation. Occasionally death results from general sepsis with parotitis, bed sores, nephritis, meningitis, or heart paralysis. The most fatal period is the third week.

Treatment.—The low mortality of this disease shows how successful all methods of treatment are likely to be considered. In the great majority of cases very little active treatment is required. Every patient with typhoid should be put to bed and kept there during the febrile period, and a few days beyond it, no matter how mild the attack may be. A fluid diet also should be prescribed in every case, preferably milk which should be given regularly every three hours, and not pushed greatly beyond the desires of the patient. Milk may be diluted or partially peptonized, and kumyss or matzoon may be substituted for it if the stomach is irritable. Plenty of water should be allowed, unless it disturbs the stomach.

The discharges should be immediately and thoroughly disinfected by a solution of carbolic 1:20. If the movements are in a chamber or a bed-pan they should be covered with this solution for at least six hours before they are thrown into the water closet. If napkins or diapers are used, they should be soaked in some efficient antiseptic solution for twelve hours and then thoroughly boiled. Sheets stained by discharges should be treated in the same way, and all bed-linen should be boiled for two hours apart from the washing of the family. Aside from these general measures the treatment of the disease is the treatment of symptoms.

Diarrhœa calls for treatment only when the movements exceed four or five in twenty-four hours. If no more than this number are present, they should not be interfered with. Opium and bismuth are undoubtedly the best means for controlling excessive diarrhœa, but care should be taken that they are not pushed to the degree of inducing constipation.

Constipation may be relieved by small doses of the salines, or an occasional dose of castor oil, but all active purgation should be avoided. In many cases daily irrigation of the colon with tepid water is better than anything else. On the whole, constipation is more troublesome to control than diarrhœa.

Tympanites is rarely severe enough to require treatment; it may be relieved by turpentine stupes, by a glycerin suppository, or a small glycerin

injection (one teaspoonful of glycerin to two ou
by the use of the rectal tube.

Whenever the temperature goes above 103
are indicated. In mild cases, sponging with c
and tepid water, equal parts, is generally suffi
not yield to such measures, baths should be em
dren the graduated bath (page 48) should be
older the bath should be from 75° to 85° F., its
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during the bath to prevent shock and cardiac dep
indications to the bath are extreme prostration
ness, or the existence of intestinal hæmorrhage.
cold bath can be employed in children makes it
cold pack (pages 47 and 48) may be substituted f
stances make the latter impracticable. The bath
in an average case in from two to four hours, or
has risen to 103° F. The method of applying c
disturbance to the patient is the one which shou

The milder nervous symptoms—headache,
etc.—may be relieved by an occasional dose of pl
in combination with the bromides, or by cold
more severe ones usually occur with high tempe
trolled by the cold bath.

Stimulants in most of the cases are not ca
given according to the indications afforded by
of the heart, and the child's general condition.
earlier than the middle of the second week; th
Brandy or whisky is to be preferred to wines, a
may be given at frequent intervals whenever th
best. Intestinal hæmorrhage calls for absolute c
mically, and turpentine or ergotine by the mout
is to be treated by hypodermics of morphine.

CHAPTER X.

TUBERCULOSIS.

TUBERCULOSIS is an infectious communicable
admitted to be due to the bacillus tuberculosis of
or general, and may involve any organ and alm
body.

Etiology.—*Frequency.*—Müller, in 500 auto
Munich, found tuberculosis in 40 per cent of t

death was due to tuberculosis, and in the remaining 10 per cent tuberculosis was found at autopsy in patients dying from other diseases. I do not think it is so frequent in this country, for, of 726 consecutive autopsies in the New York Infant Asylum, tuberculosis was found in only 58, or 8 per cent of the cases; 6 per cent of the deaths were due to tuberculosis, and in 2 per cent the children died from other diseases. Of 319 consecutive autopsies in the Babies' Hospital, tuberculosis was found in 44, or 14 per cent.

Predisposing causes.—The predisposition to tuberculosis is general or local. General predisposition may be inherited directly from parents who have themselves suffered from tuberculosis, or from those who, in consequence of syphilis, alcoholism, or any other constitutional vice, have transmitted a feeble constitution to their children. Inherited predisposition is exceedingly common, and really signifies a diminished resistance of the cells of the body to tuberculous infection. It should be distinguished from the very exceptional condition of congenital tuberculosis, where infection takes place before birth. General predisposition includes the child's surroundings, in so far as they affect the constitution and lower the general vitality. Children reared in the city, either in institutions or in crowded tenements, are more frequently affected than those who have had the advantage of the best surroundings, not only because of their increased chances of exposure, but also from their feebler resistance. Marasmus, intestinal diseases, and, in fact, any debilitating general or local disease, may predispose to tuberculosis.

A local predisposition is created by any pathological condition of the mucous membranes or organs most exposed to infection. The most important are repeated attacks of bronchitis, broncho-pneumonia, or pleurisy, and chronic catarrhal inflammation of the mucous membrane of the nose or pharynx, so frequently associated with enlarged tonsils or adenoid growths of the pharynx. Much less frequently the local predisposition is the result of some previous disease of the intestines.

The rôle played by other diseases in the development of tuberculosis is an important one, and until recently but little understood. In a very large number of cases tuberculosis develops as a sequel of one of the acute infectious diseases, particularly measles, pertussis, or epidemic influenza. In such cases there has probably existed previously a latent tuberculosis, usually in the bronchial lymph nodes. This process, sometimes long quiescent, under the stimulus of a new infection may be awakened to activity. It is to be noted that it is the infectious diseases that are intimately associated with pulmonary complications, which are liable to be followed by tuberculosis.

Age.—No age is exempt from tuberculosis. It was formerly believed that the disease was rare in infancy, but recent observations have shown that, although its form is somewhat different, it is more frequent in infancy than at any period of later childhood. Statistics, taken chiefly from injection (one teaspoonful of glycerin to two ounces water), or, better still, by the use of the rectal tube.

Whenever the temperature goes above 103° F., antipyretic measures are indicated. In mild cases, sponging with cold water or with alcohol and tepid water, equal parts, is generally sufficient. In cases which do not yield to such measures, baths should be employed. For young children the graduated bath (page 48) should be used; for those who are older the bath should be from 75° to 85° F., its duration depending upon the amount of reduction affected. The body should be actively rubbed during the bath to prevent shock and cardiac depression. The only contra-indications to the bath are extreme prostration with great cardiac weakness, or the existence of intestinal hæmorrhage. The ease with which the cold bath can be employed in children makes it especially valuable. The cold pack (pages 47 and 48) may be substituted for the bath where circumstances make the latter impracticable. The bath or pack should be repeated in an average case in from two to four hours, or whenever the temperature has risen to 103° F. The method of applying cold which causes the least disturbance to the patient is the one which should always be selected.

The milder nervous symptoms—headache, restlessness, sleeplessness, etc.—may be relieved by an occasional dose of phenacetine, either alone or in combination with the bromides, or by cold or tepid sponging; the more severe ones usually occur with high temperature, and are best controlled by the cold bath.

Stimulants in most of the cases are not called for. They are to be given according to the indications afforded by the pulse, the first sound of the heart, and the child's general condition. They are seldom needed earlier than the middle of the second week; they should be well diluted. Brandy or whisky is to be preferred to wines, and, unlike the milk, they may be given at frequent intervals whenever the patient will take them best. Intestinal hæmorrhage calls for absolute quiet, morphine hypodermically, and turpentine or ergotine by the mouth. Intestinal perforation is to be treated by hypodermics of morphine.

CHAPTER X.

TUBERCULOSIS.

Tuberculosis is an infectious communicable disease, now universally admitted to be due to the bacillus tuberculosis of Koch. It may be local or general, and may involve any organ and almost any structure in the body.

Etiology.—*Frequency.*—Müller, in 500 autopsies upon children in Munich, found tuberculosis in 40 per cent of the cases; in 30 per cent suffering from tuberculosis is also known to have caused the disease. One of the most striking instances of direct infection is that reported by Reich.[*] In a town of about 1,300 inhabitants, the obstetric practice was divided between two midwives. Within fourteen months no less than ten infants, who had been delivered by one of these women, died of tuberculous meningitis. In none of these families was there a history of tuberculosis. This midwife was found to be suffering from pulmonary tuberculosis, and died from that disease. It was her custom to remove the mucus from the mouth of the newly-born infants by direct mouth-to-mouth aspiration, and then to establish respiration by blowing into the nose. In the practice of the other midwife, who was healthy, no cases of tuberculosis occurred, although she treated the newly-born infants in the same fashion.

The following instance of infection has recently come to my notice: Two little girls were much in the room and about the bed of a young woman who was suffering, it was afterward discovered, from pulmonary tuberculosis. Within three months of that time, and within six weeks of each other, both died of tuberculous meningitis.

Examples might be multiplied indefinitely of cases where children have contracted the disease from a close exposure to nurses or other persons in the household. More frequently, however, the mode of infection can not be traced, the exposure doubtless being in most of these cases long antecedent to the development of symptoms.

Aside from accidental inoculation already mentioned, the tubercle bacilli may gain an entrance to the body either through the respiratory or the alimentary tract or the skin—the last, however, being so very rare that it need only be mentioned. In infancy and early childhood, infection through the respiratory tract is the rule. This is conclusively shown by the situation of the primary lesions (pages 361 and 1022). The source of the bacilli in the inspired air is mainly the sputum of patients suffering from pulmonary tuberculosis, which dries and becomes part of the dust of the street, of the railroad car, the home, or the hospital. Bacilli may be taken into the alimentary tract with milk from tuberculous cows or tuberculous women. Infection in this way I believe to be very rare.[†] Unless two institutions where children up to four years of age are received, give the following results, the diagnosis being confirmed by autopsy in nearly every case under two years old:

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[*] Berliner klinische Wochenschrift, No. 37, 1878.

[†] In this connection the following incident is interesting as bearing upon the other side of the question: Near a large American city was a fancy stock farm of registered Jersey cows, which supplied milk for table use and infant feeding to a large number of families in the wealthiest part of the city, for a period of over ten years. At the end of that time the tuberculin test was used for the first time, and 45 per cent of these cows were found to be tuberculous, and were killed by order of the State Board of Health. The diagnosis was confirmed by autopsies upon the animals in every instance. An investigation was instituted among the children who had been fed upon this milk, but in only one case of many hundreds could it be learned that tuberculosis had developed, and in this instance it was by no means established that the

Under three months	5 cases
From three to six months	21 "
" six to twelve months	31 "
" twelve to eighteen months	29 "
" eighteen to twenty-four months	10 "
" two years to five years	32 "
Over five years	15 "
Total	143 "

It will be seen that the first year furnished 57 cases, the second year 39, and the succeeding three years but 32 cases.

Mode of infection.—The possibility of intra-uterine infection, or the direct transmission of tuberculosis, has been demonstrated by cases recorded by Birch-Hirschfeld,* Lehmann, Bar and Rénon and others. In the case first referred to, the organs of a fœtus, taken from a woman dying from general tuberculosis, were found to contain tubercle bacilli, although no tuberculous lesions were present; bacilli were found in the capillaries of the liver; inoculations from the spleen and kidney produced the disease in animals; and the placental tufts were filled with bacilli. In Lehmann's case there were tuberculous lesions in the placenta as well as in the child's organs.

Intra-uterine infection is highly probable in many of the cases of children born of tuberculous mothers, who develop the disease during the first few months of life, although they may show no evidence of it at birth. Among my own cases there were five which died of tuberculosis during the first three months. One of these children was but twenty days old. It was born prematurely of a mother who at the time was suffering from advanced tuberculosis, and died from that disease shortly after the child. Besides other lesions, the autopsy showed, in the case of the mother, tuberculosis of the endometrium. In this instance the infection of the child certainly took place before birth.

In another case, a child died of general tuberculosis, with wide-spread lesions, at the age of seven weeks. The mother of this infant died from tuberculosis eleven days after the birth of the child. Intra-uterine infection must, however, be considered rare in comparison with the frequency with which infection takes place after birth, instead of being, as was formerly supposed, very common.

Tuberculosis may be communicated by direct inoculation, as in the case of a bite from a person suffering from the disease, several instances of which are on record. The rite of circumcision performed by a rabbi by experiments with dust inhalation in animals, that in a short time the bronchial lymph nodes were filled with dust, though the bronchi and alveoli were free; but, however prolonged the inhalation, dust was never found in the lymphatic vessels beyond the nodes.

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* Wiener medicinische Blätter, No. 17, 1891.

Arriving at the lymph node, the bacilli light up a tuberculous inflammation of varying degrees of intensity, depending upon their number and upon local conditions. This inflammation may pass through the usual changes of tuberculous glands—congestion, swelling, cell proliferation and caseation; or the process may be arrested at any point, and the products of inflammation become encapsulated by a proliferation of fibrous tissue, in which condition they may remain latent in the body for an indefinite number of years—possibly for a lifetime. This is what occurs in older and more vigorous children, and it is consistent with every outward sign of health; but it is a smouldering ember which at any time may be fanned into flame under the stimulus of an inflammation excited by some other cause.

In infants and young children, the tendency is always for the bacilli to lodge first in the bronchial lymph nodes, probably on account of the favourable conditions for entrance existing in the bronchi and lungs. In those who are delicate and have but little resistance, the process in the lymph nodes is likely to go on to caseation and softening, and secondarily to this process in the glands, the lung may become infected. Of 91 cases observed by Northrup, in which the mode of infection could be pretty accurately traced, in 88 it was primarily in the bronchial lymph nodes. The manner of the extension of the disease to the lung is not always easy to trace; but in many instances it has been shown to be the result of the softening of one of these small tuberculous lymph nodes, which then ulcerates through the wall of one of the small bronchi or a blood-vessel, in this way distributing its bacilli through the lung.

Although this is the course usually taken by bacilli when they are inhaled, it is not always the case. Lesions in the lungs are occasionally found where the lymph nodes are not involved; and there are other cases in which advanced changes exist in the lung, while only the earlier ones are seen in the lymph nodes. In these cases, which perhaps are to be considered as exceptional, the tuberculous process probably begins in the walls of the small bronchi, the alveoli, or in the connective-tissue septa.

Tubercle bacilli entering the alimentary tract rarely cause lesions of the gastric mucous membrane, or through it reach the lymphatic circulation. In the intestines, however, more favourable conditions exist. It is possible for the bacilli to reach the mesenteric lymph nodes without causing disease of the intestinal mucous membrane, but I believe it to be exceedingly rare; for by careful search I have never yet failed to find intestinal ulceration where the lymph nodes were manifestly tuberculous.

Lesions.—In the following table are given the different lesions of tuberculosis as they were found in 119 autopsies, of which I have notes. These represent the lesions of infancy and early childhood, 66 per cent of these children being two years old or under. There are introduced for comparison, the statistics of 131 autopsies from the Pendlebury Hospital Reports (Manchester, England). Very few of the cases in this series were under three years, the hospital admitting only older children :

Frequency of the Different Visceral Lesions of Tuberculosis.

ORGANS.	Personal cases ; 119 autopsies (chiefly under three years).		Pendlebury Hospital Reports ; 131 autopsies (chiefly over three years).	
Lungs......................	117	99·0 per cent.	122	93·0 per cent.
Pleura......................	69	58·0 "	100	76·0 "
Bronchial lymph nodes......	108	96·0 "	91	70·0 "
Brain......................	40	37·0 "	60	46·0 "
Liver......................	77	65·0 "	86	65·0 "
Spleen......................	88	75·0 "	76	58·0 "
Kidneys......................	46	39·0 "	54	41·0 "
Stomach..............	5	4·0 "	1	0·8 "
Intestines..................	40	37·0 "	65	50·0 "
Mesenteric lymph nodes.....	38	35·0 "	77	59·0 "
Peritonæum..................	10	9·0 "	37	28·0 "
Pericardium.................	7	6·0 "	4	3·0 "
Endocardium.................	1	0·8 "	..	....
Thymus......................	3	2·5 "	..	....
Suprarenal capsules.........	2	1·7 "	2	1·6 "
Pancreas....................	3	2·5 "	..	....

The varieties of tuberculosis seen at different ages.—During the first two years of life, tuberculosis, with great uniformity, involves first the bronchial lymph nodes and the lungs. It is most frequently the pulmonary process which is the cause of death, and next to the lungs, death is due to tuberculosis of the brain. It is rare for any other local tuberculous process to be fatal at this time of life. Of 72 cases of tuberculosis in the first two years of life, in which the exact nature of the lesions was determined by autopsy, the lungs were extensively involved in all; but death was due to meningitis in 13, in only one to tuberculous peritonitis, and in one to hæmorrhage from a tuberculous ulcer of the intestine. During infancy, meningitis is rare except when associated with pulmonary tuberculosis; but after the second year, meningitis is relatively more frequent. Of the deaths from tuberculosis during the third year, meningitis was present in over one half the number. After this time it frequently exists with few and sometimes with no lesions in the lungs, it being often secondary to tuberculosis of the bones or lymph nodes.

Beginning with the third year, tuberculosis of the bones, cervical and mesenteric lymph nodes, peritonæum, and intestines, becomes more frequent, and in any of these organs it may occur as the principal lesion, although at autopsy the lungs, even at this age, are rarely found free from infection.

Pulmonary Lesions.—As compared with adults, the pulmonary tuberculosis of children is more widely diffused, and the predominance of cases in which the lesion is at the upper lobes, though less marked, still exists. The peculiarities are principally seen in children under two years. In those who have passed the sixth or seventh year, the pathological processes resemble those of adult life. In my own autopsies the oldest lesions were found 69 times in one of the upper lobes (left 35, right 34); 23 times in the right middle lobe, and 35 times in one or other of the lower lobes (left 24, right 11). Although localized tuberculous processes are frequently met with in patients dying from other diseases, those who die from tuberculosis usually show wide-spread lesions of the lungs, and the younger the child the more diffuse they are.

1. Miliary tuberculosis of the lungs.—In nearly every case of pulmonary tuberculosis, miliary tubercles are found in some part of the lung; usually they are seen upon the surface and in scattered areas in the vicinity of some older process. Occasionally in older children, but very rarely in infants, they are distributed through nearly the whole of both lungs.

In some places the lung, with the exception of these gray granulations, appears quite normal; in others it is congested, and shows between the tubercles the lesions of simple broncho-pneumonia in its various stages. There is also an acute bronchitis of the middle-sized and smaller bronchi. The microscope shows that the tubercles usually develop in the walls of the small bronchi or the blood-vessels, or very close to these structures. In their gross appearance, the lungs in these cases resemble those in ordinary acute broncho-pneumonia, with the exception that everywhere upon the surface and throughout the substance of the lung are seen the small gray granulations, and in most cases some small yellow tuberculous nodules. The pleura is usually normal except for the presence of the tubercles. This form of the disease represents the rapid dissemination of tubercle bacilli throughout the lungs, the miliary tubercles being the result of the inflammation excited by their presence.

2. Tuberculous broncho-pneumonia.—This is the most frequent and the most characteristic form of tuberculosis in infants and young children, and it is the one which at this age usually causes death. In this form of disease there are produced in the lung, caseous nodules, or larger caseous areas, some of which have usually undergone softening by the time the case comes to autopsy. The process generally runs a somewhat subacute course. With the lesions mentioned there are always associated those of simple broncho-pneumonia.

The pleura is involved in almost every case. There may be simply dense connective-tissue adhesions which bind the lung firmly to the chest wall, or the pleura may be greatly thickened and contain caseous deposits. Occasionally empyema is seen, but it is almost always sacculated and small.

Both lungs are usually involved, but one to a much greater degree than the other. There are found large areas of consolidation which sometimes involve an entire lobe, but more often areas are seen in several lobes. These portions of the lung appear much firmer and harder than in ordinary pneumonia. The upper lobes are more often affected than the lower, and especially that part of the lobe which is near the root of the lung, on account of its frequent association with tuberculosis of the bronchial glands; the disease very often extends forward from this point to the middle lobe of the right, or the corresponding part of the left lung. On section the affected part of the lung usually shows many caseous nodules varying in size from a pin's head to a walnut, which appear of a pale yellow colour, and resemble caseous lymph nodes. They contain giant cells and are usually filled with bacilli, those which have softened containing yellow pus. There is nearly always seen in some part of the lung a large caseous area; and not infrequently there may be diffuse caseation of almost an entire lobe (Fig. 172). Sometimes no spot of softening is seen even in these large areas, but in the great majority of them there are found cavities of variable size with ragged but not dense walls.

Softening and excavation represent the final stages of the process in tuberculous pneumonia. It has been shown by Prudden that these changes are chiefly or entirely due to other pathogenic organisms—usually the streptococcus or staphylococcus—and not to the tubercle bacillus. Softening usually begins in the centre of a caseous part, often at several points at the same time. Areas of excavation large enough to deserve the name of cavities were present in thirty-five of seventy two autopsies upon tuberculous patients, two years old and under. They are found in the great majority of the cases in which continuous pulmonary symptoms have been present till death. They vary in size from a cherry to a hen's egg, and sometimes a much larger one is seen (Fig. 173). They are usually rather deeply seated, and partially or entirely filled with caseous masses or pus, but very seldom perforate the pleura, causing pneumothorax or pyo-pneumothorax. It is rare in a young child to find cavities surrounded by dense fibrous walls such as are seen in older children or in adults; for in infancy the process of softening once begun usually advances steadily until the death of the patient.

It is very frequent to find at autopsy small cavities surrounded by larger areas of caseous pneumonia, and these in turn surrounded by a zone of simple pneumonia through which are scattered many miliary tubercles. Often the lesions mentioned will be present in one lobe, while the other lobe or the opposite lung will show only the changes of a simple pneumonia.

The bronchial lymph nodes are in these cases invariably found to be tuberculous, and not only those at the root of the lung, but if a dissection is made, a chain of these tuberculous glands will be found to follow the larger bronchi for some distance into the lung (Fig. 176). Sometimes one may discover one of these which has softened and ulcerated through into a small bronchus, and in this way has spread the infection throughout that part of the lung.

Microscopical examination of these cheesy nodules shows that they most frequently begin as tuberculous deposits in the walls of the small bronchi, either in the mucous membrane, the fibrous coat, or the lymphatics; sometimes, however, they begin in the walls of a small vein or artery. Cell proliferation takes place, separating the coats of the bronchus or blood-vessel, and partly or entirely obstructing its lumen. Softening may

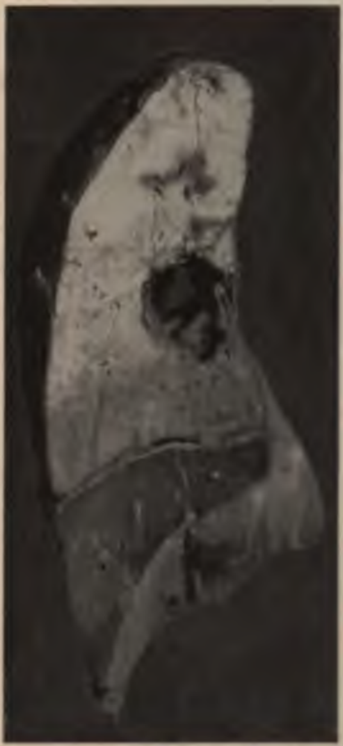


Fig. 172.

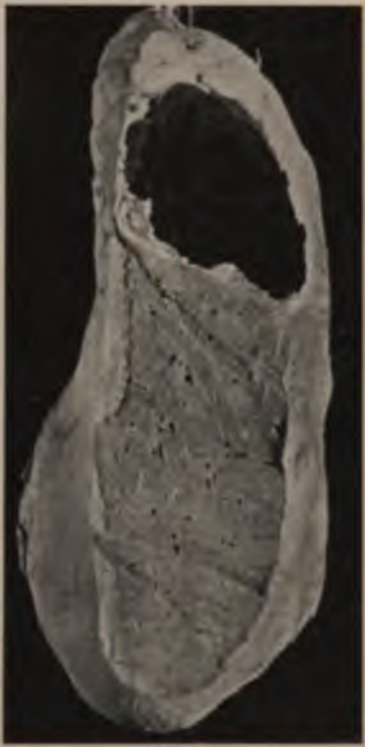


Fig. 173.

Fig. 172.—Tuberculous pneumonia. A vertical section through the middle of the right lung of a child thirteen months old. The greater part of the upper lobe is uniformly caseous—a diffuse tuberculous pneumonia; near the centre the commencement of a cavity is seen; below it has the appearance of a consolidation from simple pneumonia. The part of the lower lobe shown is normal.

Fig. 173.—Cavity from breaking down of tuberculous pneumonia; another view of the same lung, the section being made very near the posterior border of the lung. The cavity occupies at this point nearly the whole of the upper lobe. At autopsy this cavity contained numerous loose caseous masses, the largest being the size of a marble. The lower lobe is normal. (For history see Fig. 179.)

take place and the contents be discharged into the bronchus or blood-vessel. About this focus other changes of an inflammatory character occur, as a result of which each cheesy nodule is surrounded by a zone of simple broncho-pneumonia (Fig. 174) which tends, in a measure at least, to limit the tuberculous process. The larger caseous areas are formed by an extension of this process to the zone of pneumonia which surrounds it; but in its further growth it is still preceded by a simple pneumonia (Fig. 175). The rapidity with which the lesions advance differs much in the different cases, and is greatly modified by the patient's age; in infants the progress is apt to be continuous until the death of the patient; in older children it is usually slower, and is often interrupted by longer or shorter intervals of arrest and even of partial retrogression. Such periods are marked by the absorption of the simple inflammatory products in the zone of pneumonia surrounding the tuberculous nodule, accompanied by improvement in the symptoms and

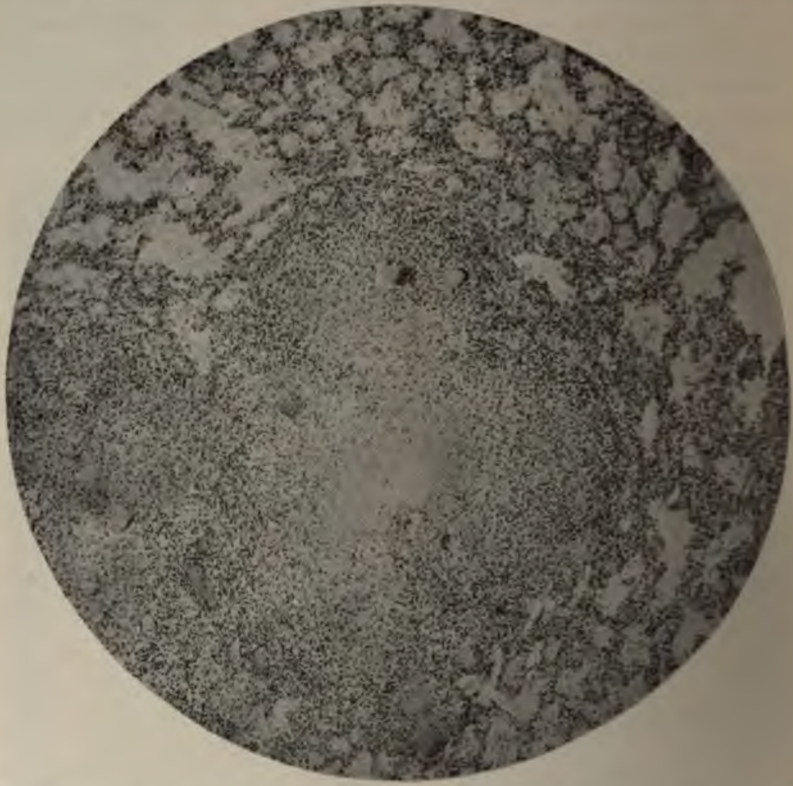


FIG. 174.—A small tuberculous nodule surrounded by lung tissue which shows only slight inflammatory changes. The centre of the nodule is necrotic; at its periphery is shown infiltration with round cells and several giant cells. (From Karg and Schmorl.)

often by a disappearance of some of the physical signs. During these times of quiescence there is an opportunity for the organization of the cells infiltrating the alveolar walls and septa into a more or less resistant fibrous wall which acts as a barrier against the advance of the pathological process.

Not infrequently one sees in the post-mortem room one or two caseous, or less frequently calcareous, nodules encapsulated by firm, organized connective tissue where a most careful search fails to show any other tuberculous lesion in the lung. If, however, the nodules are widely scattered through the lung, such an arrest of the process is not to be expected.

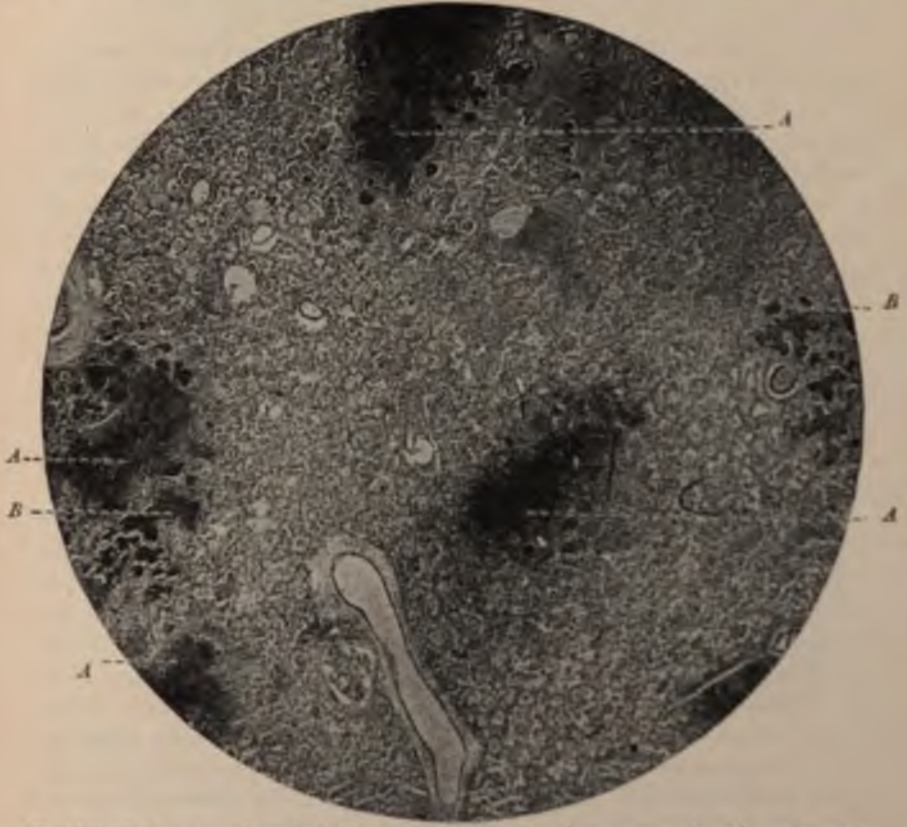


FIG. 175.—Pulmonary tuberculosis, showing areas of tuberculous pneumonia and conglomerate tubercles. In the greater part of the specimen the air vesicles are filled with the products of simple pneumonia. The larger dark areas, *A A A*, are spots of tuberculous pneumonia, while at *B B* only single air vesicles or groups of two or three are affected by the tuberculous process. The specimen shows a comparatively early stage of the process, of which the late stage is represented by Fig. 172. Patient, a child three months old; the symptoms, those of simple acute pneumonia. There were conglomerate tubercles scattered through both lungs, and large areas of cheesy pneumonia in the left lower lobe.

3. Chronic pulmonary tuberculosis, chronic phthisis.—With the patho-

logical process as it is seen in adults, we have nothing to do in infants and very young children. In those who have reached the age of eight or ten years the disease is essentially the same as in adult life, and need not be described here.

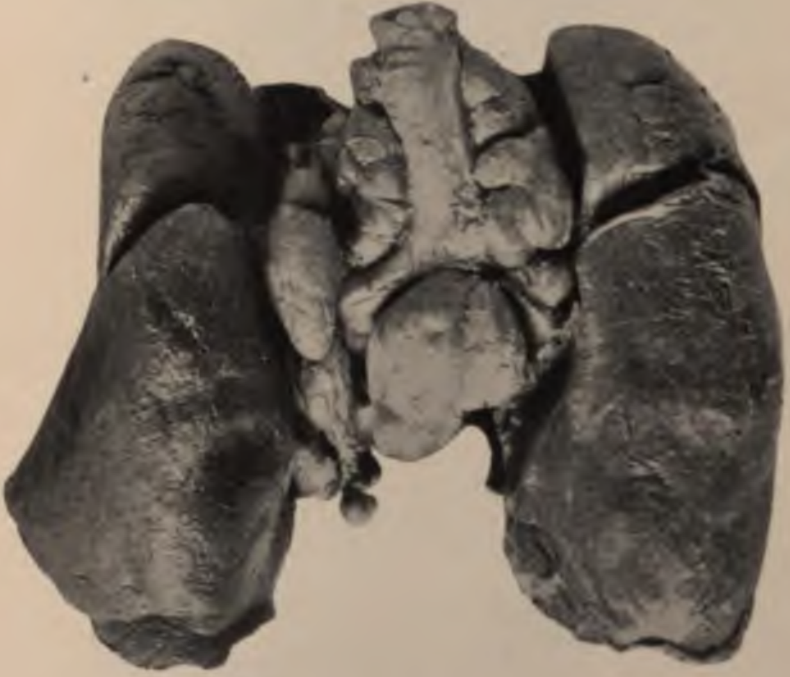
In little children the nearest approach to this condition is seen in the cases of tuberculous broncho-pneumonia, which run a slow, irregular, and somewhat chronic course. The essential features of the process in these patients is a chronic interstitial broncho-pneumonia with tuberculous nodules which rarely undergo softening, but usually become encapsulated.

The gross lesions closely resemble those of simple chronic broncho-pneumonia (page 535). There are the same generalized pleuritic adhesions and the shrunken cicatricial condition of the part of the lung most affected, with bronchiectasis, compensatory emphysema, etc. The tuberculous nodules are old and for the most part converted into dense fibrous tissue in the centre of which, however, some softened, caseous areas are often seen. Lesions like those described, which may be regarded as a form of recovery, are usually found in patients who have died of other diseases; sometimes in those who have died of other forms of tuberculosis —of the brain, bones, or peritonæum; at other times they are associated with a recent process in some other part of the lung. The bronchial glands may be somewhat enlarged and contain encapsulated caseous masses, or they may be calcareous.

Bronchial lymph nodes (*bronchial glands*).—The prominence of the lesions of the lymph nodes is one of the most striking features of tuberculosis in infancy and early childhood. Those which are most frequently affected are connected with the bronchi. The lymph nodes, to which the term "bronchial glands" is generally applied, consist of three groups: the first of which surround the trachea; the second are situated at the bifurcation of the trachea and surround the primary bronchi; while the third follow the course of the bronchi into the lung, being found, according to anatomists, as far as the fourth division. The anatomical relation of the different groups should be borne in mind, since upon them the symptoms principally depend. The first group, or the peri-tracheal lymph nodes, are in relation with the superior vena cava, the pulmonary artery, the pneumogastric and recurrent laryngeal nerves; the second group, at the bifurcation of the trachea, with the œsophagus, pneumogastric nerve, and aorta; the third group, with the bronchi and the branches of the bronchial and pulmonary arteries and veins.

All the groups are usually involved at the same time, but in varying degrees, and in most cases those belonging to one lung to a greater extent than the other; in my own cases those of the right side have more often been involved than those of the left. There may be simply two or three tumours as large as a hazelnut, or there may be a mass two or three inches

PLATE XIX.



Tuberculosis of the Tracheo-Bronchial Lymph Nodes.

From a fairly nourished child, four months old, who was under observation for three weeks, with slight fever and a most severe, teasing, dry cough, which was almost constant, and upon which no treatment seemed to have the slightest effect. At first there were no signs of disease in the lungs; later there were a few coarse scattered râles.

There were small tuberculous deposits throughout both lungs, with quite a large area of cheesy pneumonia in the right middle lobe, and scattered miliary tubercles in other organs.

in diameter, which is made up of ten to twenty of these nodes fused together by inflammatory products, completely surrounding the trachea and both the large bronchi. It is rare that the individual glands are more than an inch in diameter, and most of them are smaller than this.

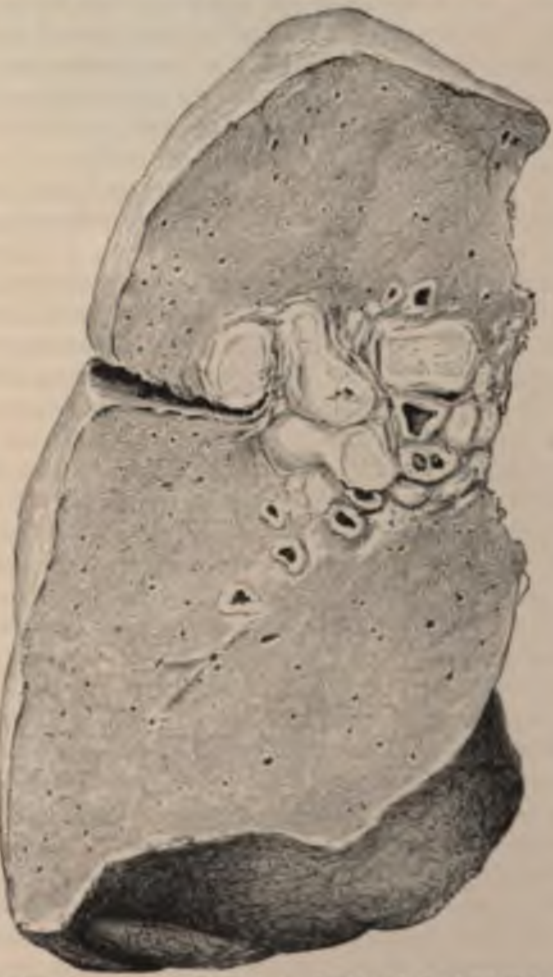


FIG. 176.—Tuberculous bronchial lymph nodes. Section of the lung of an infant through cheesy bronchial lymph nodes at the root of the lung, and adjacent cheesy masses, several of which have softened at the centre; the lung otherwise normal; life-size. (After Northrup.)

A well-marked but not unusual example of this condition is shown in Plate XIX. There is usually found a chain of these tuberculous glands following the course of the large bronchi for some distance into the lung; sometimes these are almost as large as the external group (Fig. 176); at other times they are not noticed unless a somewhat careful dissection is made. The process is not infrequently more advanced in these deeply-seated glands than in those situated at the root of the lung; and lesions here are also more important, as it is very frequently through them that the lung becomes infected.

The pathological changes through which these glands pass as a result of tuberculous infection, are very similar to those already described with reference to the cervical glands (page 825). Suppuration is less frequent than in the region of the neck, while calcific degeneration is much more so. This applies especially to children over three years old. In infancy suppuration is not infrequent in the bronchial glands, while at this age calcification is extremely rare. Infection of these lymph glands is not always followed by general tuberculosis or even by infection of the lung. Although the process has gone on to caseation, these inflammatory products with bacilli may become encapsulated, and may remain innocuous for an indefinite period. The bacilli may die or may exist here, living, for years. At any time the old process may be lighted up, and a more or less rapid dissemination of tubercle bacilli take place through the lungs or through the whole body. Latent tuberculosis more frequently exists in the bronchial lymph nodes than in any other structure in the body.

Secondary lesions may be produced by these lymph nodes. The pneumogastric and recurrent nerves may be surrounded by one of these cheesy masses which causes pressure and irritation. The œsophagus, the trachea, or the bronchi, may be compressed or opened by ulceration. The superior vena cava usually suffers only compression, but this or any of the other large vessels may be opened. Ulceration may also take place into one of the large or small bronchi or the trachea. If the gland has softened and broken down, and if the bronchus is a small one, the only result of this may be a rapid spreading of tuberculous infection throughout the lung. If sudden rupture occurs, a large caseous mass may escape into the trachea, or a large bronchus, with a result similar to that produced by any other foreign body. If suppuration occurs, the abscess may rupture into the surrounding cellular tissue, causing mediastinal or retro-œsophageal abscess (page 276). This may open externally at the suprasternal notch, or in the first or second intercostal space, or may ulcerate into any of the large vessels, the œsophagus, or the pericardium, or may burrow downward into the peritoneal cavity.

Pleura.—This is rarely normal in any case of tuberculosis. In acute general tuberculosis the only lesion may be a deposit of miliary tubercles upon the visceral pleura. In most of the other cases there are found fibrous adhesions over the part of the lung involved, binding it to the pericardium, the diaphragm, or the chest wall. The amount of thickening of the pleura varies a good deal, but is rarely great. In about one fifth of my own autopsies tuberculous nodules were found in the pleura; with these lesions there is usually considerable thickening. Pleurisy with a hæmorrhagic exudation is very rare in the tuberculosis of early childhood. Empyema is also rare, being seen in but five per cent of my cases, and then it was small and sacculated. Pneumothorax and pyopneumothorax are very rare in children under three years of age; they were not seen in any of my cases.

Heart.—It is exceptional for the pericardium to be affected even in the most generalized forms of miliary tuberculosis. In such cases the usual lesion is a deposit of a few gray tubercles upon the visceral surface. In chronic cases other lesions analogous to those of the pleura may be seen, but all are rare in childhood. In a single instance I have seen miliary tubercles upon the endocardium. They are extremely rare, and the development of cheesy nodules in the heart is almost unknown in early life.

Brain.—Tuberculosis of the brain is not uncommon during infancy, being then associated in nearly all cases with general tuberculosis, and especially with tuberculous pneumonia; but it is relatively twice as frequent after the second year. There may be found miliary tubercles alone, or these may be accompanied by inflammatory products—tuberculous meningitis—or there may be caseous nodules. Miliary tubercles are frequently found in small numbers in cases which have presented no symptoms. The lesions of tuberculous meningitis have already been described (page 715). Cheesy nodules are rare in infancy, being noted in but 2·5 per cent of my own autopsies, which were mainly on children under three years old; while in the Pendlebury Hospital cases, including those between four and twelve years old, they were noted in 24·4 per cent. These nodules vary in size from a pea to a child's fist; they are usually associated with tuberculous meningitis, but they may exist alone. When they are large they rank as cerebral tumours, being most frequently seen in the cerebellum. They rarely soften, but may be the seat of calcareous deposits.

Liver.—This is frequently involved in general tuberculosis, although it is doubtful if it is ever the seat of primary infection except in the congenital cases. Usually the only lesion is the presence of miliary tubercles on its surface and in its substance, and in most cases these are not numerous. They are found in about two thirds of the cases. In a smaller number there are tuberculous nodules of various sizes. In nearly every protracted case the liver is markedly fatty. In very late cases of tuberculosis of the bones, it is frequently the seat of amyloid degeneration.

Spleen.—This is more frequently affected than the liver, but in very much the same way. In most of the cases of general tuberculosis, miliary tubercles are present in the spleen, these being usually numerous, both upon the surface and throughout the organ. Not infrequently small tuberculous nodules are also seen, but there are rarely any which are larger than a pea. The size of the spleen is not altered if only miliary tubercles are present; but with the tuberculous nodules it may be much enlarged.

Amyloid degeneration is found under the same conditions as in the liver.

Stomach.—Tuberculosis of the stomach is one of the rare lesions; both its contents and its acid reaction seem to protect it against direct infection from the mouth. Tuberculous ulcers were seen in five of my autopsies, which is a larger proportion than is usually noted.

Intestines.—These are less seriously affected in infancy than in older children, which is rather surprising when we consider how susceptible are the intestines of infants to other forms of infection. The explanation of this difference seems to me to be this: Intestinal infection is nearly always secondary to disease of the lungs; primary lesions being extremely rare. Infants usually die from the more rapid tuberculous processes in the lungs or brain before there has been time or opportunity for intestinal infection to occur. The opportunities for such infection depend upon the number of bacilli which are coughed into the pharynx and swallowed. In infancy this number is small, because of the many who die of tuberculous pneumonia or meningitis before extensive softening in the lungs has taken place. In older children the slower course of the pulmonary disease gives ample time for intestinal infection, while the more extensive softening and excavation are accompanied by the discharge of a much larger number of bacilli. The intestinal lesions and those of the mesenteric lymph nodes with which they are almost invariably associated, are described on page 361.

Peritonæum.—In infancy the peritonæum is not often involved even in general tuberculosis, and at this age it is very rare for it to be the seat of the principal tuberculous process. This occurred but once in my own 119 autopsies. In older children it is more frequent; of the 131 Pendlebury Hospital cases, the peritonæum was involved in 37, or twenty-eight per cent. In most cases of general tuberculosis there are only deposits of miliary tubercles; less frequently there are tuberculous nodules with other inflammatory products. The lesions in these cases are described with Diseases of the Peritonæum (page 420).

Thymus gland.—In three of my cases tuberculous nodules were found in the thymus body, the size varying from a small pea to a hazelnut. Some of the largest nodules had undergone softening at the centre. All these were cases showing widely disseminated tuberculous lesions.

Pancreas.—In three of my cases this organ also was the seat of small tuberculous nodules, all of them being cases of general tuberculosis.

Uro-genital organs.—Serious tuberculosis of any part of the urinary tract is very rare in children. Miliary tubercles were found in the kidneys in about one third of my autopsies on tuberculous patients. They are generally few in number. Tuberculous nodules of the kidney I have seen but once in a young child. They are very rare before the fourteenth year (page 623). In two of my autopsies tuberculous nodules were found in the suprarenal capsules. Tuberculosis of the testicle has been observed in rare instances among children, although not in one of my own series. Koplik (New York) has reported several cases.

Tuberculosis of the bones and of the external lymph nodes have already been described (pages 825 and 837)

THE CLINICAL FORMS OF TUBERCULOSIS.

I. GENERAL TUBERCULOSIS.—Cases of tuberculosis present a wide variety in their symptomatology. Almost every case possesses some peculiar features which depend upon the constitution of the patient, the source of infection, the rapidity with which the bacilli are disseminated through the body, or the numbers in which they enter. The general symptoms usually precede the local ones, but in probably the majority of cases they are masked and unrecognised. It is not often possible to recognise tuberculosis until the process is quite well advanced in some one organ. The early symptoms in most cases are very indefinite and susceptible of many explanations.

1. **Cases Resembling Infantile Marasmus.**—In early infancy, tuberculosis often gives at first and for a long time only the symptoms of marasmus. Infants are pale and thin, they do not gain in weight, and finally become emaciated. There is nothing characteristic about these symptoms, and it should be remembered that they depend much more frequently upon simple marasmus than upon tuberculosis. There may be no cough and no fever sufficient to attract attention, and the case may even go on to a fatal termination without any symptoms except those of infantile marasmus. This I have seen at least a dozen times in cases that came to autopsy.

More frequently, however, there are developed toward the end of the disease both the symptoms and signs of pulmonary disease and fever. These are generally found together, as the process in the lungs is the cause of the rise of temperature. The febrile symptoms are often not seen until the last two or three weeks of life. The course of the temperature is irregular. It is never of the hectic type and rarely high. The usual range is between 100° and 102° F. The pulmonary symptoms are generally few and not very well marked. There is usually some cough, but it is rarely severe. The breathing is more rapid than would be explained by the temperature alone. Severe dyspnœa and cyanosis are rare, and are seen only at the close of the disease. The physical signs are those of either localized bronchitis or of broncho-pneumonia.

The other symptoms usually relate to the digestive tract. There may be indigestion, with occasional vomiting and green undigested stools, or there may be diarrhœa. The intestinal symptoms depend on the general condition of the child and the constitutional disease, rarely upon a tuberculous process in the stomach or bowels.

If the case has gone on to the development of constant fever and recognisable physical signs which slowly spread, the infant's fate is sealed. The progress of the case from this time is steadily downward, and the child can live at most but a few weeks. Death generally occurs from progressive asthenia without the development of any new symptoms. Occasionally toward the close, cerebral symptoms rapidly develop, and the child is carried off in a few days by tuberculous meningitis; sometimes there is a rapid spreading of the disease in the lungs, and death occurs with symptoms of simple acute pneumonia.

Diagnosis.—The difficulty in diagnosis is chiefly during the first year of life. Every circumstance in the patient's surroundings and family history which bears upon the development of tuberculosis must be weighed to establish the fact of inheritance or of exposure to contagion. In simple wasting, the usual history is that the infant was plump and well nourished at birth. A sufficient cause for its condition can in most cases be found in improper or insufficient nourishment or the want of proper care. (See causes of marasmus, page 204.) Often the wasting follows some acute disease of infancy, most frequently some form of gastro-intestinal disease.

In tuberculosis, the infant may show all the signs of malnutrition at birth, but in most cases they are of later development. They either come without adequate cause, or are associated with pulmonary disease or they follow measles or pertussis. No explanation of the wasting can be discovered in the food, the surroundings, or in the condition of the digestive organs. Diarrhœa and vomiting more frequently follow than precede it. The above facts are sufficient to warrant a suspicion only that tuberculosis is present until some local manifestation occurs, usually in the lungs. The early wasting without adequate cause, followed by the gradual development of low fever, and finally the appearance of signs of subacute broncho-pneumonia, form the most characteristic features of general tuberculosis in early infancy. Yet all these symptoms are occasionally met with in cases in which the autopsy shows none of the lesions of tuberculosis, for simple broncho-pneumonia frequently occurs in patients suffering from marasmus; but in such cases fever is usually slight and it may be absent.

The wasting and cachexia of hereditary syphilis sometimes resemble tuberculosis, but the early history in syphilis is usually so characteristic, and other symptoms of the disease are so rarely wanting, that the mistake is not likely to be made if a patient is submitted to a careful examination. In the absence of definite syphilitic symptoms the chances are greatly in favour of tuberculosis.

2. **Cases in Older Children with Symptoms Resembling a Continued Fever.**—Before the development of fever in these cases, there is usually quite a protracted period of very indefinite symptoms, each one of which alone is unimportant, but all of which taken together should excite sus-

picion. Such children are usually delicate; they are persistently anæmic without sufficient reason; they often show a loss in weight; there is a marked cachexia, sometimes a capricious appetite, and a digestion easily disturbed. In some of them a change in disposition is observed, and they become peevish or fretful and are disinclined to muscular exertion. All these symptoms indicate a gradual decline in the general health.

This clinical picture may be due to many causes, but it should always arouse in the mind of the physician a suspicion of incipient tuberculosis, particularly in a child who by surroundings or inheritance is predisposed to that disease. After these indefinite symptoms have lasted a few weeks fever is added. Sometimes the prodromal symptoms are absent or unnoticed and fever is the first evident symptom. This fever is peculiar in that it comes without evident cause and without any local manifestations of disease. The temperature is not often high, but it is continuous. The tympanites and the rose-coloured spots are not present, but the general aspect of the patient is strikingly like that belonging to typhoid fever.

After the fever has lasted from one to three weeks there develop some signs of localized tuberculosis, generally in the lungs, or the fever may decline gradually, and although the patient improves he does not get well. He is still weak and does not gain in weight, and the thermometer shows the existence of a very slight amount of fever. Before long he may grow rapidly worse and the course of the temperature becomes irregular, with alternate exacerbations and remissions. Such an irregular and inexplicable fever sometimes puzzles the physician for three or four weeks before the characteristic features which stamp the process as tuberculous are present. One general symptom is almost invariably associated with the fever, viz., wasting. This may not be rapid, but is progressive. The tuberculous cachexia is frequently unmistakable; but in most of the cases one must wait for the process to advance far enough in some one of the organs to give local signs or symptoms before he can be sure of tuberculosis. In four cases out of five this is in the lungs. Less frequently it is in the peritonæum, the brain, or a general infection of the lymph glands throughout the body. If in the lungs, the process manifests itself as a broncho-pneumonia whose tuberculous character may be suspected from its localization—the apex or the middle of the lung in front—but chiefly from the fact that the general symptoms, fever and wasting, have for so long a time preceded the local signs of disease. From this time, the course of the disease may be that of a typical tuberculous broncho-pneumonia.

If the tuberculous process is localized in the brain, we have dulness, vomiting, headache, apathy, irregular pulse, irregular respiration, and finally convulsions and coma—in short, the symptoms of tuberculous meningitis; if in the peritonæum, we have abdominal distention from gas or fluid, tenderness, pain, diarrhœa, or constipation; if in the lymph glands, there is a general enlargement of those situated in the neck, and sometimes those of the axillary and inguinal regions, with symptoms indicating similar changes in those at the root of the lung.

Diagnosis.—In distinguishing general tuberculosis from typhoid fever, very great stress is to be laid on the family and previous history of the patient and the surroundings, as favouring tuberculosis. On the other hand, the prevalence of typhoid fever in the family, the neighbourhood, or the institution in which the case occurs, is important. The extreme infrequency of typhoid in children under two years old should always lead the physician to scrutinize very carefully every case in which he is disposed to make such a diagnosis at that time of life. In typhoid, the course of the fever is more regular than in tuberculosis, but less so than in the typhoid of adults, and the spleen in nearly every case is sufficiently enlarged to be easily felt below the ribs. The rose spots are usually present. But the most conclusive evidence is that afforded by the blood reaction in Widal's serum-test; without this, by the gradual cessation of the fever in the third or fourth week and complete recovery of the patient.

In tuberculosis, on the contrary, the fever is less regular. It commonly shows wider fluctuations, the spleen is not usually enlarged, and there are no rose spots. Tympanites and abdominal tenderness are sometimes seen, but the fever shows no disposition to stop after the third week, and the wasting is continuous. The signs in the lungs, at first few, increase from day to day. In most cases one must wait for ten days at least, and in many three weeks, before a positive diagnosis can be made.

II. Tuberculous Broncho-Pneumonia.—This occurs clinically under the following conditions: (1) It may begin in the lungs or extend to the lungs from the bronchial glands, the symptoms in either case being essentially pulmonary from the outset. (2) It may follow either form of general tuberculosis described—that resembling marasmus in infants, or that resembling a continued fever in older children. In both of these the pulmonary symptoms develop gradually in the course of the general symptoms of the disease. (3) It may occur in the course of any of the forms of local tuberculosis,—of the bones, peritonæum, intestines, external lymph glands, or skin. In such cases the invasion of the lungs frequently marks the last stage of the process. (4) It may follow any of the infectious diseases, especially measles or pertussis, even though they are not complicated by broncho-pneumonia, but more frequently when they are. (5) It may follow single or repeated attacks of simple bronchitis or pneumonia.

Clinically the cases may be divided into three groups: First, the most rapid ones, lasting from one to three weeks; secondly, those running a more protracted course, with a duration of from three weeks to three months; thirdly, those which are more or less chronic. In the first two groups the progress is nearly always steadily downward, and a fatal termination the almost inevitable result; in the third form the course is more irregular, and marked by a series of exacerbations and remissions.

1. **The Most Rapid Cases.**—In this form of the disease there are found scattered through certain portions or nearly the whole of both lungs, miliary tubercles and minute tuberculous nodules, the intervening parts of the lung being involved more or less seriously in a simple inflammation. In most of the cases the clinical picture is that of simple acute broncho-pneumonia, for it is to the accompanying broncho-pneumonia, and not to the scattered tuberculous deposits themselves, that the symptoms and the physical signs are due. The development of the disease, although acute, is not usually abrupt. There are present, fever, cough, dyspnœa, accelerated respiration, prostration, and sometimes cyanosis. The temperature in these cases is never hectic, but its course is a somewhat irregular one the usual range being between 100° and 104° F. In most of the cases it differs in no respect from the temperature of simple broncho-pneumonia. Sometimes it is seen that the general symptoms are severe and the physical signs wide-spread, and yet the range of temperature is not high. To be sure, this is occasionally seen in a simple broncho-pneumonia, but it is more frequent in tuberculosis. The cough early in the disease is slight, but later becomes severe and often distressing. In infants and young children it may be of a paroxysmal character, resembling pertussis. Expectoration is wanting in infancy, and is not often seen in those under seven years, so that bacilli in the sputum is a symptom of only a small number of cases. Bloody expectoration, likewise, is rare in children.

The conditions in the lungs which give physical signs are bronchitis of the smaller tubes, with areas of complete or partial consolidation. In character, these signs are identical with those of simple broncho-pneumonia (page 499). They may be scattered throughout the whole of both lungs; but when localized they are more frequently in the upper than in the lower lobes, and rather more frequently in front than behind. Although both lungs are involved, they are usually not affected to the same degree. The patient may die before signs of complete consolidation are present; more often there are during the last few days small areas of partial consolidation, as shown by broncho-vesicular breathing, exaggerated voice, and slight dulness. These signs may be due to the simple broncho-pneumonia, and are often found in the lower lobes behind. Large areas of complete consolidation, with pure bronchial breathing, bronchial voice, and marked dulness are infrequent.

From the beginning of acute symptoms the progress of the disease is steadily downward, death resulting from the same causes as in simple broncho-pneumonia. The end is marked by cyanosis, great dyspnœa, weak pulse, and extreme prostration. In a few cases there develop shortly before death cerebral symptoms, indicating tuberculous disease of the

brain. Such symptoms may be the first to le
the process to be a tuberculous one. In these
convulsions in two or three days from the fir
other cases the course is slower, with the typica

2. **The More Protracted Cases.**—In this fo
found in the lungs caseous nodules, with lar
monia, and usually some spots of softening. T
generalized as in the cases just described, but

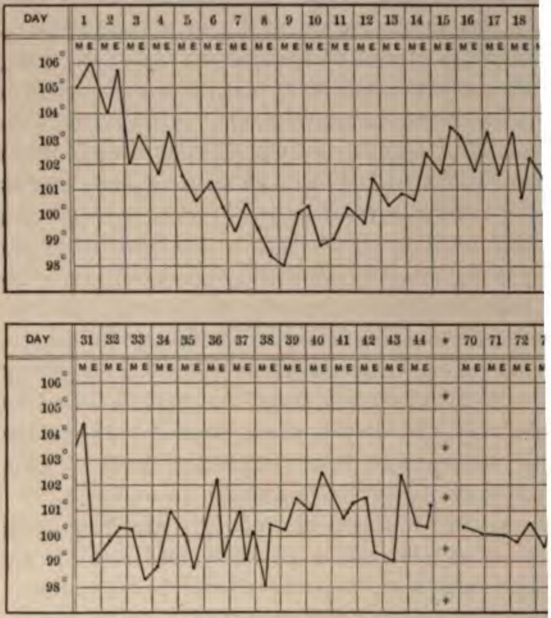


FIG. 177.—Tuberculosis following measles. Child sixteen m
tion. Chart begins on fifth day of a severe but uncomplic
a natural decline to normal. Fever then returned and co
later. Record for the period which is omitted was much
cedes and follows. Early symptoms not acute, only slow
with scattered râles throughout chest. Signs of consolida
then present in right upper lobe. Toward the end, rapi
symptoms, and signs of cavity at right apex. Autopsy
tuberculous deposits throughout both lungs and in nearly

associated a certain amount of simple pneumon
quent and most characteristic form of pulmona
and early childhood. Its usual duration is from
course is then steady and uninterrupted. In it
it lasts from three to six months, and its course

The mode of onset will depend upon the co
disease develops. When the general symptoms
wasting,—have preceded those in the lungs, th
is gradual, with cough, rapid breathing, dyspno

etc. When the pulmonary symptoms are present from the beginning, they are the same as in simple broncho-pneumonia, with the exception that they usually come on less acutely. The latter is true of cases which are secondary to some other form of tuberculosis in the bones, peritonæum, etc.

When pulmonary tuberculosis follows measles (Fig. 177) or whooping-cough which has been complicated by simple pneumonia, the early symptoms may present no unusual features. After two or three weeks the temperature gradually falls, and the physical signs improve, but neither quite disappears. The cough continues, though its severity somewhat abates. In the course of a few weeks the child, who has meanwhile improved somewhat in his general condition, becomes distinctly worse, often without any assignable cause. The temperature rises to 102° or 103° F.; the cough increases, and an extension of the disease in the lungs is evident by the physical signs. In other cases the progress of the disease after the pneumonia which complicated measles is without an intervening period of apparent improvement. It sometimes happens that the attack of measles or whooping-cough is not accompanied by any serious pulmonary symptoms, and the case goes on to apparent recovery, except that there remain anæmia, a slight cough, and fever. The temperature, although not high, persists; but it may be two or three weeks before there are present definite symptoms and signs of disease in the lungs.

Fever is a constant accompaniment of all active tuberculous processes in the lungs in the child as in the adult, it being absent only during the periods of remission which occur in the cases of slow and irregular progress. It is a very important guide to the progress of the disease. The early fever depends chiefly upon the coexisting broncho-pneumonia, and its course resembles that of simple pneumonia of the protracted variety. There is no typical curve. The fever is not often steadily high, and in many cases it is never high (Fig. 178). It frequently runs for

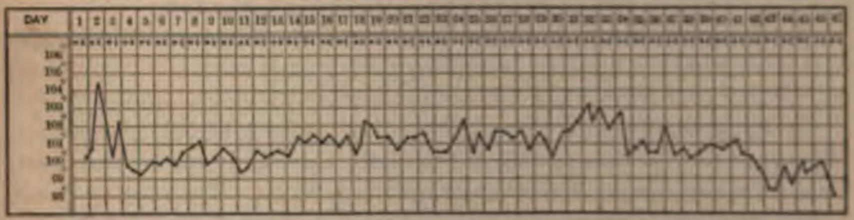


FIG. 178.—Tuberculous pneumonia, general tuberculosis. Patient eleven months old, and under observation at the time he was taken sick. Chart of entire illness is given. Disease began as an acute pneumonia in lower part of left axilla and spread to entire lower lobe. Early signs of consolidation; at end of two weeks, flatness so marked that a needle was inserted, fluid being suspected. Vomited frequently, and had loose discharges from bowels throughout the illness; abdomen much swollen for last two weeks. Autopsy showed cheesy pneumonia of part of the upper and the entire left lower lobe, where were two small cavities. Recent tubercles found throughout right lung, and extensive deposits in abdominal organs with peritonitis, intestinal ulcers, etc.

several days between 99° and 102° F., and t
rises to 104° F. or over; again, it may be sc
together. In infants the morning temperatu
although the evening temperature may be 10
the close of the disease, when softening and
going on, the regular hectic temperature of
young child (Fig. 179). While the presence

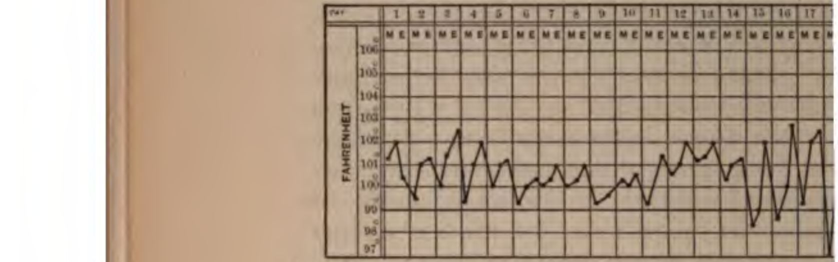


FIG. 179.—Tuberculous pneumonia, with extensive softenin
thirteen months old; weight, ten pounds; came under
with consolidation at apex of right lung. Signs increas
until there were heard, from clavicle to below the nipp
breathing and many moist râles; percussion note was
treme apex. No distinct signs of a cavity; no hectic fe
large cavity (Fig. 173) at right apex partly filled with ca
monia (Fig. 172) of the rest of right upper lobe, with sc
the opposite lung, and a few in the abdominal organs.

cance, its course has almost no diagnostic imp
cially should one beware of drawing the conclu
is not hectic, therefore there is no breaking do

Sweating belongs only to the late stage of
associated with the hectic type of fever; both
in children over seven years old, but not in ve

Wasting, like fever, is characteristic of all
Whenever they are associated, tuberculosis s
no matter how obscure the other symptoms m
always rapid, but it is usually continuous whi
periods of temporary improvement, children
but may actually gain in weight. In the earl
ing is especially suggestive when it continu
after measles or pertussis, or when it persists
in spite of a good appetite and apparently
first be so slight as not to be noticed unless t
obscure cases this steady loss of weight is a
value, and is frequently overlooked. Toward t
is rapid and frequently extreme emaciation.

Cough, although almost invariably present,
may be hard, dry, or suppressed; it sometim

sembling pertussis, which may or may not depend upon the presence of enlarged bronchial glands.

Expectoration is absent in infants, the matters coughed up being swallowed. In children over seven years old, we often get a profuse muco-purulent expectoration, but it is very exceptional below this age.

Hæmoptysis is a rare symptom, but not unknown even in young children. Henoch has reported a case of fatal hæmoptysis in a child ten months old, where the hæmorrhage was due to the rupture of an aneurism in the wall of a cavity. Herz, in 247 clinical cases of tuberculosis in children, records 8 of hæmoptysis—4 of them under five years, and the youngest only eighteen months old. The records of 131 autopsies on tuberculous children in the Pendlebury Hospital, show that hæmoptysis was four times a cause of death; two of these patients were under five years, and one was only twelve months old. I have never met with a case of hæmoptysis under five years old. As in adults, fatal hæmoptysis is usually due to the opening of a large vessel by ulceration in the wall of a cavity, which is sometimes in the lung and sometimes in one of the bronchial glands.

The respiration in all cases of tuberculous pneumonia is accelerated, and usually out of proportion to the rise in temperature. As the lung becomes more and more extensively invaded there is constant dyspnœa. The pulse is rapid in the early stage, and continues so throughout the disease; toward the end it becomes weak and irregular. Irregular respiration and a slow, irregular pulse, may occur at any time from the development of cerebral complications.

Pleuritic pains in the chest are not frequent in children. Gastro-intestinal symptoms, such as indigestion, vomiting, diarrhœa, etc., are generally present, but are not peculiar in this disease. They usually depend upon the patient's general condition, only exceptionally upon tuberculous disease of the stomach or intestines. The characteristic symptoms of intestinal tuberculosis—abdominal pain, tenderness, uncontrollable diarrhœa, and intestinal hæmorrhage—are not often met with in children under five years. With such symptoms, and sometimes when they are doubtful or absent, careful palpation of the abdomen may disclose the presence of enlarged mesenteric glands. When these are not readily felt through the abdominal walls, they may sometimes be discovered by a rectal examination after the method of Carpenter (London).

The spleen is often enlarged, sometimes very much so, but this does not occur with sufficient frequency to be of much diagnostic value. It may be due to tuberculous deposits, to causes connected with the lungs or heart, or to fever. The liver is never enlarged from tuberculous deposits, but may be so from amyloid or fatty degeneration, or from obstructed circulation, as in the case of the spleen.

Dropsy is rare and seen only toward the close of the disease. It may depend upon anæmia, upon complicating nephritis, especially amyloid de-

generation, upon cardiac or pulmonary condit
with the return circulation, or upon pressure
neal or mesenteric glands upon the inferior v
fingers is occasionally seen in cases running a
is due to obstructed circulation.

Anæmia is commonly associated with wasti
portance where the latter is slight or absent.
acute disease in infancy when not dependent o
ever, it is associated with low fever, cough, and
chest, it should always excite apprehension.

3. **Chronic Tuberculous Pneumonia.**—In yo
interstitial pneumonia associated with tubercu
have usually had their beginning in one of th
scribed. The primary attack runs a tedious, p
a slow convalescence and apparent recovery, alt
Often a slight cough remains, or returns from
other exciting cause. The child does not re
vigour, and careful examination of the lungs
signs remain. There are frequently present
dulness over the affected part of the lung,
sounds may be heard.

After a few months, possibly, the child has
the first and running the same tedious course.
cough, and perhaps there is a fresh consolidatio
generally in the neighbourhood of the old dis
finally subside, and most of the signs of recent
usually found then that the lung is not quite i
was before this second illness. The acute attac
times and pass under the name of bronchiti
pleurisy. They may extend over a period of
longer. The general health in the interval is no
in most cases anæmia, with the usual symptoms
dren are regarded as being very delicate.

The course of this disease thus differs in no
that of simple chronic broncho-pneumonia (pag
likewise are identical in character, although the
tion. They are generally found in the same sit
the more rapid forms of pulmonary tuberculos
fatal result in these cases is usually brought ab
(1) by the development of acute tuberculous pn
culosis of the lungs, occurring with the sympto
exacerbations which has come on without appa
followed an attack of measles or whooping-co
meningitis; (3) by a simple acute broncho-pneu

Physical Signs of Tuberculous Pneumonia.—Speaking generally, there is no difference in a young child between the signs of a tuberculous and those of simple broncho-pneumonia except in their position; for cavities, although they are present at autopsy in most of the cases, are very rarely of such size and so situated as to be recognised during life. In children over seven or eight years old, and sometimes in those of five or six, the signs are essentially like those in adults.

By reference to the description of the lesions (page 1023) it will be noted that the upper lobes are the seat of the most advanced disease twice as frequently as the lower lobes, and the right lung rather more frequently than the left. When the disease is in the upper lobes it is rarely at the extreme apex, and when it is in the lower lobes it is very exceptional to find it at the base, posteriorly. The region most often involved is the middle zone of the lung. If the signs appear first behind they are, in the great majority of cases, in the interscapular space; if in the lateral part of the chest, they are in the middle or upper part of the axilla; if in front, they are in the mammary region, more frequently above than below the nipple, but rarely extending quite to the clavicle. In other words, it is near the root of the lung that the disease most frequently begins, spreading thence forward more often than backward. The explanation of this is found in the fact that the disease in infants and young children so often extends from the lymph nodes at the root of the lung to the lung itself. The physical signs themselves may be grouped under four heads, corresponding to the pathological conditions existing in the various stages of the disease—viz., (1) localized bronchitis; (2) partial consolidation; (3) complete consolidation; (4) excavation. The early signs in the first two stages are identical with those described in broncho-pneumonia (page 499), those of the third stage being the signs of the persistent form (page 502). As a rule, however, the transition of the signs from one stage to another is much slower in tuberculous than in simple broncho-pneumonia.

As stated in the description of the lesions, cavities are found in the lungs in the majority of cases of infants dying from tuberculosis of the lungs. It is, however, rare that they can be recognised in children under three years old. From three to eight years they give more positive signs, and after eight years practically the same signs as in adults. The reason why in infancy cavities are so seldom recognised during life is because they are generally small, often centrally located, nearly always filled with thick pus or cheesy matter, and rarely communicate freely with the bronchi. On the other hand, it is very common to find signs in young children which, if heard in adults, would be regarded as almost positive evidence of a cavity, although none is present. These signs are cracked-pot resonance and cavernous breathing. They are not usually due to bronchiectasis, since this condition belongs to chronic cases, and especially to older children; but most frequently to consolidation about a large bronchus superficially situated—viz., below the clavicle, high in the axilla and in the interscapular region. The wide area over which this broncho-cavernous breathing is heard, is one of the most striking points of difference from the signs of a cavity.

Course, Duration, and Termination.—Whatever may be the evolution of the symptoms, and the variations are almost endless, the cases fall readily into two groups,—those in which the progress is rapid and steady and those in which it is slow and intermittent. The duration of the first group is from four to eight weeks. Fever is constant, wasting progressive, and the physical signs show a steady advance of the disease in the lungs. Dyspnœa becomes severe and constant; the pulse grows more and more rapid and feeble; and death occurs from exhaustion, pulmonary œdema, or syncope, less frequently from meningitis.

In the second group the duration is from two to six months. The course can not better be described than as a succession of attacks of broncho-pneumonia, sometimes separated by an interval of several weeks, at other times one coming on before the first is fairly over. During exacerbations the symptoms resemble those of the first form, there being marked fever, wasting, cough, and dyspnœa. The child may seem hopelessly ill when, without any special reason, a change for the better occurs, the acute symptoms abating and the signs of consolidation in great measure disappearing. Toward the end of the disease the pulmonary and constitutional symptoms become constant, and frequently there are added symptoms due to extension of the tuberculous process to other parts of the body—the brain, peritonæum, intestines, mesenteric glands, etc. These cases die, as do the more acute ones, from the local disease in the lungs or from general infection.

Diagnosis.—The evidence upon which a diagnosis of tuberculosis is made, is of two kinds,—that which relates to the patient and that which relates to the local disease. In any case, a diagnosis is reached by weighing the evidence as a whole rather than by relying upon the presence of particular symptoms or physical signs. One should investigate the family history, surroundings, and previous condition of the patient; also the mode of onset, and course of the disease, and consider the evidence afforded by the examination of the patient.

A careful examination of the family history should be made to determine, first the existence of phthisis in the parents or in other members of the family, near or remote. Children more often inherit tuberculosis from the mother than from the father, and are more likely to contract it from her, owing to the closer contact. It is not enough simply to investigate the question of phthisis. Inquiry should be made regarding meningitis, disease of the cervical glands, spine, hip, knee, or ankle, especially in the other children of the family. These points are important not only to establish the fact of heredity but also the probable chances of exposure.

Other conditions favourable for acquiring the disease should be considered, such as in a private family exposure to nurses or other members of the household; also whether the surroundings have been such as would give opportunities for infection, as in cases where a child has been reared in a tenement house, or has been long an inmate of a hospital or other institution. In the child's previous history, it is important to know whether there have been other manifestations of tuberculosis in the cervical glands, spine, hip, knee, or ankle, or the skin; also whether he has been liable to attacks of severe or protracted bronchitis or broncho-pneumonia. If he has had measles or pertussis, it is important to know whether they were severe, accompanied by pulmonary complications, or followed by a protracted cough or obscure fever. The child's general constitution should be considered, whether he is delicate, narrow-chested, poorly nourished, or anæmic.

In its symptoms and course it is with simple broncho-pneumonia that tuberculous disease is likely to be confounded, hence the important diagnostic points are those which distinguish these two processes from each other. The onset of simple pneumonia is usually rapid and often abrupt; tuberculous pneumonia, although it sometimes begins in one of these ways, usually develops gradually with constitutional symptoms preceding the local ones by several days or even weeks. When tuberculosis develops rapidly, the pulmonary symptoms and the physical signs may be identical in the two conditions. During the period of acute symptoms there is often nothing either in the constitutional or local symptoms to awaken suspicion. One may be struck with the disproportion between the general symptoms—loss of flesh, prostration, and temperature—and the local evidences of pulmonary disease. When the patient dies in the early acute stage the disease is rarely recognised, nor, indeed, can it be diagnosticated with certainty. Usually it is not until the time for resolution to occur that the course of the disease suggests something different from broncho-pneumonia. The question then arises whether we have to deal with a case of persistent broncho-pneumonia or with tuberculosis. It should be remembered that it is not infrequent for simple broncho-pneumonia to resolve slowly or to go on to the development of chronic interstitial pneumonia; and that local conditions as determined by physical signs, which in adults would be regarded as certainly tuberculous, very often in children are simple processes.

Often the course of the disease, after the first acute period has passed, furnishes further evidence to clear up the diagnosis; but not necessarily, for in tuberculosis it may be steadily downward, or it may be marked by periods of remission and exacerbation, and the same is true of simple pneumonia. Fever is a more constant symptom in tuberculosis, and it is usually higher than in persistent broncho-pneumonia; but the exceptions are so many and the variations so wide that it is not safe in young children to lay very much stress upon the temperature curve. Anæmia and wasting are more marked in tuberculosis, and in most cases progressive. A copious muco-purulent expectoration is seen almost as frequently in pneumonia as in tuberculosis; but in neither disease is it common under five years. The presence of the bacillus tuberculosis in the sputum is, of course, positive evidence of tuberculosis.

Simple broncho-pneumonia may affect any part of the lungs, but by preference the lower lobes posteriorly. The signs of tuberculosis may likewise be found anywhere, but most frequently in the anterior part of the lung, the mammary region, the axillary margin, or the apex; if posterior, the signs are usually at the apex or in the interscapular region. From the character of the physical signs, no inference can be drawn unless a cavity can be positively made out; but when the process has advanced to that stage, the diagnosis is generally plain from the general symptoms.

Meningitis developing during a pulmonary disease of doubtful character, is generally tuberculous, and its occurrence is usually to be interpreted as establishing the tuberculous nature of the process in the lungs; but this is not invariable, as simple meningitis may follow simple pneumonia, as I have more than once seen proven by autopsy, when both were regarded during life as tuberculous. The development of cheesy lymph glands in the neck, the groin, or axilla, or the presence of symptoms pointing to enlargement of the bronchial glands, or those of chronic peritonitis with or without ascites, or intestinal hæmorrhage,—all point strongly to tuberculosis.

If the acute symptoms begin during measles and persist, they may be due either to broncho-pneumonia or to tuberculosis. If, however, they begin insidiously during convalescence from measles, they are very probably due to tuberculosis. If the symptoms begin acutely during pertussis, they may be due to simple broncho-pneumonia or a tuberculous process; but if they develop gradually and insidiously after pertussis, the disease is probably tuberculosis. It should not be forgotten, however, that it is not uncommon for simple broncho-pneumonia occurring with pertussis, to persist until the attack of pertussis has subsided. I have seen several such cases in which consolidation has lasted two or three months and yet cleared up entirely.

If the child was previously healthy and living in good surroundings, and if the disease began with acute symptoms, the process is simple pneumonia in nine cases out of ten, no matter how irregular its course, how prolonged its duration, or what the physical signs. The physician will more frequently be right in his diagnosis if he bases it upon the general condition and previous history of the patient, than upon the special symptoms of the disease or the physical signs. Still, after all has been said, the diagnosis is in all cases difficult, and in some, particularly the more chronic ones, a positive diagnosis is impossible, as no one knows so well as he who has an opportunity to follow his cases to autopsy.

III. CHRONIC PHTHISIS.—This form of tuberculosis, with its chronic hectic fever, slow cavity formation, progressive emaciation, night sweats, etc., is very rarely seen before the fifth year, and it is not at all frequent until the tenth or twelfth year. In its symptoms, course, termination, and physical signs, it resembles the same disease in adults, and need not be described at length here.

IV. TUBERCULOSIS OF THE BRONCHIAL LYMPH NODES (BRONCHIAL GLANDS).—This condition is usually associated with some form of pulmonary tuberculosis, but it may exist as the most important and sometimes as the only tuberculous lesion.

Its symptoms are usually associated with those of pulmonary or general tuberculosis; but they may occur when the pulmonary changes are too few to be recognised either by symptoms or physical signs. From the great frequency with which this lesion is found in infants and young children, it might be expected that local symptoms would be common in such patients. They are, however, in my experience, quite exceptional. Most of the cases in which well-marked symptoms occur are in children over two years old, and it is between the third and tenth years that they are usually seen. In infancy, although these glands are almost invariably affected, death in the great majority of cases occurs from the pulmonary disease, before the later changes in the glands have had time to develop.

General symptoms indicating a tuberculous cachexia may or may not precede the local ones. The latter are chiefly mechanical, and depend upon the size of the glands and upon their anatomical relations, and very little or not at all upon the nature of the changes in them. The most important relations, so far as the production of symptoms is concerned, are those which they bear to the pneumogastric and recurrent laryngeal nerves, the superior vena cava, the trachea, and bronchi; those less important are to the aorta, pulmonary artery, and œsophagus.

Pressure upon or irritation of the pneumogastric or recurrent nerves produces cough, dyspnœa, and sometimes a change in the voice. The cough is hoarse, persistent, and teasing, and frequently occurs in paroxysms which in many respects resemble those of pertussis, but it lacks the characteristic whoop, and is not accompanied by the expectoration of the mass of tenacious mucus. These paroxysms are severe and often prolonged, but careful observation shows distinct differences from those of pertussis, though by an unfamiliar ear the two are easily confounded. The dyspnœa, like the cough, is paroxysmal, and sometimes strongly resembles ordinary spasmodic croup; at other times it is like a severe attack of asthma. Such symptoms may come and go, but they are frequently prolonged, and usually in the interval between the severe seizures the patient is not wholly free from dyspnœa. Although the chief cause of dyspnœa is no doubt nerve irritation, it may be due in part to pressure upon the trachea or one of the large bronchi. In dyspnœa from pressure on the trachea the head is usually thrown back, and the obstruction is more frequently on expiration than on inspiration.

After such symptoms as those mentioned have existed for a few days or weeks, and in some cases without any warning, there may occur a sudden attack of asphyxia which may prove fatal. This is generally due to ulceration of a caseous gland into the trachea or a large bronchus and the escape of a large mass into the air passages, where it produces the same effects as any other foreign body.

Loeb has collected fifteen cases of this description, a summary of which gives a good idea of the circumstances under which this accident usually occurs: In four cases death took place in the first attack of suffocation, the only previous symptom having been cough; in three there had been a number of milder attacks extending, in two of the cases, over a considerable period before the occurrence of the fatal one; in three, death occurred in the first attack, in children who had no previous cough and who were apparently healthy; in one, the fatal attack came on during pertussis. In the majority of the cases, death followed in from five to ten minutes from the first symptom; in a few the patients lived for an hour. In rare cases after ulceration into the trachea, the patient has coughed up a large quantity of foul pus, and recovered.

Pressure upon the superior vena cava is usually associated with spasmodic dyspnœa and cough, and causes cyanosis of the face and blueness of the lips. There is frequently a puffiness of the face, and there may be marked œdema. The coexistence of cyanosis with such œdema, when the urine is free from signs of renal disease, should always lead one to suspect pressure at the root of the lung. In some rare cases the interference with the return circulation has been so marked that meningeal hæmorrhage has resulted. By a process of ulceration set up by these glands they may open, not only into the air passages, but into the pericardium, the œsophagus, or any of the large vessels. The last mentioned is usually followed by instant death. Aldibert reports two cases in which the pulmonary artery was opened, death occurring from hæmoptysis, as there was also a communication with one of the large bronchi. In Vogel's case the subclavian vein was perforated, and death resulted from the entrance of air. If ulceration takes place into the surrounding connective tissue, a mediastinal abscess may result, producing any of the pressure symptoms noted above, and, in addition, dysphagia from pressure on the œsophagus. Such an abscess may point in the supra-sternal notch; it may open through the chest anteriorly between the ribs or at the xiphoid cartilage; or it may burrow along the œsophagus to the peritoneal cavity. As a rule, however, patients die of general tuberculosis before the local conditions have advanced so far.

Physical Signs.—In order to produce physical signs, the mass of tuberculous lymph nodes must be large enough to form a mediastinal tumour, or so situated as to produce pressure on the trachea or bronchi. As a rule, the signs are more characteristic behind than in front. Percussion may give dulness anteriorly over the first piece of the sternum or posteriorly along one or both sides of the spine from the second to the fifth dorsal vertebra; the dulness is rarely complete. Auscultation posteriorly may give in the most marked cases amphoric or cavernous breathing, or exaggerated bronchial breathing with prolonged expiration, in those which are less pronounced. Large, moist râles are sometimes heard. The auscultatory signs are so like those of a cavity that it is often difficult to believe that a cavity does not exist. The sounds heard appear to be those produced in the trachea and bronchi transmitted to the ear with great exaggeration by the mass of lymph nodes which surrounds them and fills the space between them and the chest wall. When the head is thrown back a venous hum may sometimes be heard. If one of the primary bronchi or one of its lobar divisions is compressed, there may be very feeble respiration over one lung or one lobe; if the pressure is sufficient to prevent the entrance of air, or if one of these large tubes has been plugged by a caseous mass, there is an absence of respiratory murmur over a single lobe or an entire lung. This sign is of great diagnostic value, but it is not often present.

Diagnosis.—Enlargement of the bronchial glands to a sufficient degree to produce symptoms, may occur in syphilis, in Hodgkin's disease, and in various forms of malignant disease of the mediastinum. A certain amount of swelling is seen in nearly all cases of simple bronchitis or pneumonia, especially in those running a subacute or chronic course. Whether this simple hyperplasia is ever sufficient to cause such symptoms as those mentioned is exceedingly doubtful. I have myself never known it to produce anything more marked than a spasmodic cough. The great infrequency of other forms of enlargement to a sufficient degree to be of clinical importance, usually warrants us, from the symptoms mentioned, in making the diagnosis of tuberculosis. The development in a child of a chronic abscess in the anterior mediastinum, is almost always due to tuberculous glands; and so is one in the posterior mediastinum, provided Pott's disease can be excluded.

The most important points for diagnosis are the association of a spasmodic cough with paroxysms of dyspnœa resembling asthma or croup, and œdema or congestion of the face. More stress is to be laid upon the symptoms than upon the physical signs; the latter are at most only confirmatory. The chief difficulty in diagnosis is found in those cases which present few or no other signs of tuberculosis, and which come first under observation with attacks of dyspnœa or asphyxia resembling laryngeal stenosis. In many such cases tracheotomy has been done without

finding any cause for the dyspnœa, the autops
ulceration and impaction of a caseous gland.

General Prognosis of Tuberculosis.—The o
with general or pulmonary tuberculosis is alw
disease remains confined to the lymph nodes, t
danger, except from accidents connected with
ation, which after all are rare. Spontaneous
glands in the same way as in others in the
tion, calcification, etc. Such a result is no d
exactly how often it occurs it is impossible to
disease has gained any headway in the lung it
almost certain in a young child. In those who
resistance the chances of an arrest of the process

If the bacilli have gained entrance into the
numbers, even though they are shut up in
bronchial gland, the patient is never free fro
infection.

Prophylaxis.—The prevention of tuberculosi
erence to its cause. The first essential is the d
bacilli wherever they exist. Since most of the
are derived from the sputum of patients affecte
culosis, it should be insisted upon, everywhere a
sputum from such cases should be collected in sp
destroyed either by germicides or by fire. Th
needless exposure. A tuberculous mother shoul
her child nor kiss it upon the mouth. A wet-
free from any tuberculous taint. No nurse or
ever be employed about children who has, or e
tuberculosis. It is wise to exclude also those who
from tuberculosis of the bones or the cervical gl
ger from such persons is extremely slight. If act
any member of the family, a young child should
room, and if possible should not reside in the
should infected persons be allowed to kiss childr
bed with them. The danger from drinking-cups
not be forgotten. A tuberculous person should
dishes, or the utmost care should be taken to boil
used. Cows whose milk is used for children should
nary inspection and should have passed the tuberc
where the slightest doubt regarding the health of t
the source of the milk is unknown, the milk sho
perature of 167° F. for twenty minutes. The dang
the alimentary canal is very much less than throug
and consequently the precautions first mentioned

tant than those relating to the food, although the latter should on no account be neglected.

In the case of delicate children and those of tuberculous parents or with other tuberculous relatives, everything possible should be done to fortify them against the disease. They should be kept under more or less constant medical supervision as regards their clothing, manner of life, etc., and should take cod-liver oil every winter. Every attack of bronchitis or broncho-pneumonia should be watched with the greatest solicitude. Exposure to measles or pertussis should especially be avoided. The country rather than the city should be chosen for residence, and the child should spend the winter and spring in some warm, dry climate, such as that of southern California, or the interior of South Carolina, or Lakewood, N. J. Parents should be distinctly taught that watchfulness and care do not mean coddling or the keeping of children in the house the greater part of the time. Such children should live as much as possible in the open air, and every form of sport encouraged which tends to keep them there. Overheated houses are one of the most prolific agencies in perpetuating a delicate condition of health. Plenty of fresh air in sleeping apartments should always be insisted upon. All catarrhal troubles of the nose and pharynx should receive early and prompt attention, especially should hypertrophied tonsils and adenoid growths of the pharynx be removed, since these are conditions which form a most favourable nidus for the growth of tubercle bacilli.

Treatment of General and Pulmonary Tuberculosis.—If fresh air and a proper climate are necessary for the cure of this disease in adults, they are tenfold more necessary in the case of children. Without them there is little hope for a child with active pulmonary tuberculosis. Nowhere do these cases do so badly as in a hospital located in a city, and no class of hospital cases do worse than these. The same regions that are beneficial for adult cases usually agree with children, with the exception that the latter, as a rule, do better in a warm than in a cold climate. Plenty of fresh air and sunshine are essential. A child must be where he can be kept in the open air for at least several hours each day, in spite of fever, cough, or other acute symptoms.

For the most acute cases where the children are confined to the bed, the largest, best-ventilated, and sunniest room available should be secured, and a window should be open the greater part of the time. The general management of such cases is the same as for those with acute pneumonia.

No specific remedy for tuberculosis has as yet stood the test of experience. The diet is a matter of the utmost importance. Tuberculous patients must be fed like most other sick children, care being taken not to disturb the digestion by the unnecessary use of drugs. For a staple article of diet, milk is the best, and where this is not well borne some of its substitutes—kumyss, matzoon, etc.—may be tried. Cream is almost as use-

ful as cod-liver oil, and should be given in one
the child can take it.

The two drugs which are most useful are
Creosote may be given both by the stomach an
of pneumonia. By the stomach there may be u
shellac-coated pills containing one or two dr
who are younger, it may be given in combinat
noids or in an emulsion with cod-liver oil. It
as a single dose more than half a drop to a
five years, two drops may often be given. It s
long period. Cod-liver oil is usually best give
though some children bear the pure oil better
tion. Inunctions of this or other oils are of som
tolerated by the stomach. Arsenic, iron, and t
hypophosphites are all useful as general tonics,
tion is very questionable.

When symptoms pointing to tuberculosis of
present, the syrup of the iodide of iron should b
in disease of the cervical glands. When they u
larger bronchi, they generally cause death, no m
are on record a few cases in which tracheotomy
condition, but in the great majority it accomplis

CHAPTER XI.

SYPHILIS.

SYPHILIS is a communicable disease due to a s
a certain bacillus, first described by Lustgarten, i
syphilitic tissue, it is not established that this b
disease.

In infancy and childhood both the acquired
of syphilis are seen.

ACQUIRED SYPHILIS.

While acquired syphilis is very much less freq
variety, it is by no means a rare disease in early l
that some of the manifestations of syphilis in l
usually denominated "late hereditary syphilis,"
quired form.

Etiology.—An infant may be infected by its
tion; but this is extremely rare and can take
are lesions upon the mother's genitals. Infe

be from a mother who contracts syphilis subsequently to the birth of the child, and may occur through nursing or accidental contact by kissing, etc. In either of these ways children may be infected by wet-nurses, or from a venereal sore upon the nipple. Whether syphilis can be communicated through the milk when the nipple is perfectly healthy and free from fissures, is somewhat doubtful.

Syphilis may be communicated directly from a syphilitic child to one who is healthy by kissing, sexual contact, or indirectly by means of bottles, spoons, cups, clothing, etc. The latter mode of infection is most likely to occur in institutions. Vaccination was formerly a not infrequent mode of communicating syphilis, but since the general introduction of bovine virus this is very rarely seen. Cases have been recorded by Taylor, Hutchinson, and others where the disease has been conveyed by the rite of circumcision, either from the mouth or the instruments of the operator.

The relative frequency of the different sources of infection is shown by Fournier's statistics of forty cases: The source of infection was the parents in nineteen; nurses, in eight; servants, in four; sexual contact, in four; vaccination, in two; other children, in two; a physician, in one. The ages at which the disease was acquired in this series of cases were as follows: during the first year, nineteen; during the second year, ten; during the third and fourth years, seven; from the fifth to the fourteenth years, six.

Symptoms.—The symptoms of acquired syphilis in children are in all respects similar to the same disease in the adult. A primary sore is present at the site of infection, which is most frequently the lips, the mouth or some part of the face; very rarely is it seen on the genitals. There are very few individual symptoms belonging to hereditary syphilis which may not also be present when the disease is acquired. Its course, however, is very much milder in the latter and a fatal termination is rare. Fournier states that of his forty-two cases only one died of marasmus. This marked contrast to hereditary syphilis is due chiefly to the fact that in the acquired variety the infant is rarely affected during the early months of life, a time when hereditary syphilis is so very fatal.

Tertiary symptoms may appear at any time from three to twenty years after the original infection.

The treatment is the same as in hereditary syphilis.

HEREDITARY SYPHILIS.

Etiology.—A child may inherit syphilis from both parents or from either separately. If both parents are syphilitic, the child is usually but not invariably so. The symptoms, however, are not more severe than when the inheritance is from one parent only. The likelihood of transmission depends upon the stage of the disease in the parents. If both

are suffering from secondary symptoms, trans
If active treatment has been employed for seve
born at a period when no active symptoms are p
are of a tertiary character, the offspring will pr
children are more likely to suffer severely fro
ones, provided infection of the parents has tak
of all the children.

Infection from the father.—Syphilis may be
alone. In this case the disease is probably co
the semen to the ovum. It is more likely to
father than from the mother, as the child is
the mother has few or no active symptoms. Of
Meyer in which the father alone was syphilitic,
macerated in eleven cases, and nine children
syphilis, all but one dying soon after birth. It
for the father to convey syphilis when he is free
he is suffering from tertiary symptoms only.

Infection from the mother.—It is certain th
mitted when the mother alone is diseased, as
women who have acquired syphilis while wet-n
have subsequently borne syphilitic children, the
If the mother only is syphilitic the probabiliti
child appear to be considerably less than if the
If the mother's symptoms are tertiary the child

*Both parents healthy at the time of conceptio
during pregnancy.*—Under these conditions the
syphilitic. Transmission to the child is much
mother is infected during the last two month
earlier, although, as Hutchinson's cases conclusiv
tainty that the child will escape. Diday states
fected before the fourth week and proper trea
child will usually escape on account of the relat
maternal circulation during this early period.

Can a healthy mother bear a syphilitic child?
ciated the following proposition, the truth of whi
verified since his time: "A new-born child affect
lis, even although it may have symptoms in t
ulceration of the breasts which it sucks if it be th
although continuing capable of infecting a strang

Caspary inoculated with syphilis a woman,
had aborted with a syphilitic child; the result
experiment was made by Neumann, with a like
case of an apparently healthy woman who had
infected husband; later, by a second husband wh

she had a syphilitic child. The conclusion seems irresistible that the carrying of a syphilitic child gives immunity to the mother against the disease, and that this immunity is due to the fact that she herself suffers from syphilis, or a modification of that disease. According to Hutchinson, the modified syphilis acquired by a woman under the circumstances mentioned, bears to syphilis acquired from a chancre a somewhat similar relation to that which vaccinia bears to smallpox. The mother under these circumstances can not be inoculated, either by her syphilitic nursing-infant or artificially.

Lesions.—Death may be due to syphilis, and yet the autopsy may reveal no characteristic anatomical changes, and in fact there may be no demonstrable changes in any of the organs. This is sometimes the case in children dying from syphilis soon after birth, but it is especially likely to be the case with infants who die from syphilitic marasmus during the first few months. Syphilis in these cases acts more as an indirect than as a direct cause of death. The most important lesions of hereditary syphilis are found in the bones, liver, spleen, and mucous membranes.

Bones.—In the case of a syphilitic fœtus, a stillborn child, or one dying soon after birth, the changes in the bones are more uniformly present than are any other lesions. They are in fact rarely wanting, and it is by them usually that syphilis is recognised post mortem. These early changes were first fully described by Wegner, and since then have been studied by Kassowitz, Taylor, and others. The long bones are principally affected, the most important changes being found at the junction of the shaft with the epiphyseal cartilage. The lesion is termed an epiphyseal osteo-chondritis or acute epiphysitis. There are in the early stage congestion, swelling, and cell proliferation, which may be followed by separation of the epiphysis, suppuration in the neighbouring joint, osteomyelitis, and necrosis. These changes, as well as those belonging to late syphilis, are more fully considered under Diseases of the Bones (page 851).

Liver.—This is probably more frequently involved in the fœtus and newly-born infant than any other organ. The syphilitic lesions of the liver have been studied very fully by Hudelo.* He describes as present in the youngest infants an interstitial hepatitis, a gummatous hepatitis, and a combination of the two varieties.

In the interstitial form, which is most frequent in infancy, there are first a congestion and swelling of the organ, with the exudation of leucocytes in groups. The liver is enlarged, frequently very much so, but presents few other gross changes. Later there is increased exudation between the liver cells, new connective tissue forms, and atrophy of the liver cells takes place, with obliteration of some of the portal and hepatic vessels. This process may be diffuse, but it is usually in patches. Groups of miliary syphilomata may also be found. If the process is diffuse, the liver is large, firm, and of a grayish-yellow colour. If it is localized, the affected areas are yellow or gray and the other parts are normal.

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* Monograph, Paris, 1890.

The gummatous form is not frequent in early infancy, but belongs to a little later period. In this there may be miliary syphilomata with interstitial changes, and in addition the formation of small or large gummatous tumours, which may be softened at the centre. They are surrounded by zones of new connective tissue and the liver cells are atrophied. Amyloid changes may be present.

In the late form of hereditary syphilis, usually seen in children over four or five years old, the liver is rarely affected. Hudelo was able to collect but forty-seven such cases. The lesions resemble those of the congenital variety. There are found cirrhotic changes, which may be diffuse or circumscribed, and gummatous deposits, which vary from a minute size to that of a cherry; there may be amyloid degeneration.

Spleen.—This is almost invariably enlarged in newly-born children with syphilis and in syphilitic fœtuses, but nothing characteristic is found under the microscope (Birch-Hirschfeld). In older children the enlargement of the spleen is apt to be greater than at birth; the organ may be the seat of interstitial changes, and sometimes there may be gummatous deposits. These changes are rare in children under two years of age.

Respiratory system.—In syphilitic infants which are stillborn and in those which die soon after birth, there is frequently found in the lungs what is known as "white pneumonia." This process consists, according to Hillier, in fatty changes in the epithelium of the air vesicles; with this there is associated a certain amount of interstitial pneumonia, which is chiefly peri-bronchial. In older cases the interstitial pneumonia is extensive, and the lungs may be the seat of gummatous deposits, which soften and form small cavities. Accompanying these changes there may be bronchiectasis, emphysema, and the usual secondary lesions which follow chronic interstitial pneumonia. In syphilitic infants there is a strong tendency for all inflammations of the lungs to become chronic.

The trachea and bronchi are in rare cases the seat of stenosis, which results from cicatrization following the softening of gummatous deposits in their walls. Lesions of the larynx (page 457) are also infrequent. There is usually perichondritis, which more often involves the epiglottis than any other part, and sometimes there is the formation of papillomatous masses; but ulceration and stenosis are both rare.

The nasal mucous membrane in the early stage of the disease is very constantly the seat of a chronic catarrhal inflammation, which may be accompanied by superficial ulceration. In the late cases there is deeper ulceration, from the breaking down of gummata, with extension to the periosteum, cartilages, and bones, causing perforation of the septum, necrosis of the bones, etc.

Nervous system.—Syphilitic lesions of the brain and cord are rare in children as compared with adults, and they are especially so in infancy. The most characteristic cerebral lesion of the newly-born child is hydrocephalus, which may depend upon ependymitis, as in two cases reported by D'Astros, the disease proving fatal in the second month. Syphilitic meningitis is exceedingly rare under two years. There is occasionally seen in young infants a chronic basilar meningitis (page 721) of syphilitic origin. Chronic pachymeningitis associated with gummata has been observed as early as the fourth year. Money (London) has reported a case with symptoms beginning at eleven months, in which there was chronic meningitis with great thickening of the dura mater and cerebral sclerosis. A few other cases of a similar nature have been recorded.

Syphilitic endarteritis of the brain has been observed by Chiari in a child only fifteen months old. In this case there was chronic meningitis, with endarteritis, thrombosis, and minute spots of yellow softening. Gummata are very rare before the fourth year, although Barlow's patient with multiple gummata at the base, was only fifteen months old. Nearly all the syphilitic lesions of the nervous system which are seen in adult life have been observed in childhood, although they are infrequent, and in young children they are extremely rare.

Digestive system.—Chronic catarrhal pharyngitis is almost a constant symptom of the early cases. Later there is seen superficial or deep ulceration of the pharynx, tonsils, or fauces, which may lead to perforation of the soft palate or to the formation of condylomata.

There are no important lesions of the stomach or intestines either with early or late syphilis. The rectum is occasionally the seat of ulceration, and condylomata may form even in young children.

Organs of special sense.—Otitis is a frequent accompaniment of the early syphilitic pharyngitis. It is very likely to become chronic, and in many cases results in a permanent impairment of hearing. Iritis is relatively rare in children, but it may occur even in intra-uterine life, as shown by the presence of adhesions in newly-born children. It is usually seen in infants four or five months old, and is always serious. Interstitial keratitis occurs frequently as a late manifestation of syphilis. Choroiditis and optic neuritis are both occasionally seen, but they are rare.

Genito-urinary organs.—Nearly all these may be affected, but generally in the late period of the disease. There may be chronic interstitial nephritis and more rarely gummatous deposits in the kidney, interstitial changes in the suprarenal bodies, and orchitis, which usually affects the body of the organ, rarely the epididymis; it is generally an interstitial inflammation, with or without gummatous deposits.

Among the less frequent visceral lesions may be mentioned, abscesses of the thymus, which are usually small and multiple; enlargement of the pancreas, with an increase of connective tissue and glandular atrophy; and chronic peritonitis. The lesions of the mucous membranes will be considered under Symptoms.

Symptoms.—As the result of syphilis, abortion may take place at any period of pregnancy, with the discharge of a dead or macerated fœtus, or the child may be stillborn at term, or it may be born alive prematurely, but with so feeble a vitality that it survives but a few hours. Under these circumstances it is often difficult and sometimes impossible to decide positively with reference to the existence of syphilis. Maceration of the fœtus or peeling of the skin is no proof, and even the examination of the internal organs may not be conclusive. Lomer examined 43 fœtuses, all dying before the thirtieth week of pregnancy; he found the spleen and liver enlarged in all, and marked bone changes in 21. Birch-Hirschfeld examined 108 newly-born syphilitic infants; he found the spleen invariably enlarged; typical bone changes were present in 35, but in many cases the bones were normal. Mervis, from an examination of 92 syphilitic fœtuses, states that no eruption upon the skin was found earlier than the eighth month.

Symptoms are present at birth in only a small number of cases. In such there is usually a very severe degree of infection, and the infants do not often live more than a few days. Upon the skin there may be seen an eruption of pustules, papules, or bullæ. The bullæ are usually upon the soles and palms, but may be found upon other parts of the body. The name "syphilitic pemphigus" is often given to this condition. Pemphigus in the newly born, however, is not invariably due to syphilis, but may be present in other conditions of low vitality. The bullæ are at first small, and then coalesce and form larger ones two inches or more in diameter. They contain a turbid serum which is sometimes tinged with blood, and sometimes yellow from pus. Pustules, when present, are usually seen upon the face or scalp. The general appearance of these infants is wretched in the extreme. The body is wasted, the skin wrinkled, and temperature subnormal. The spleen is usually enlarged and often the liver also. They suck feebly or not at all, and usually die from inanition within two weeks.

In the great majority of cases the infant appears healthy at birth, and continues so for a variable time before the manifestation of the characteristic symptoms of syphilis. As a rule, the more intense the infection, the earlier the symptoms make their appearance. The earliest symptoms are generally seen between the second and the sixth weeks. If three months pass without evidence of syphilis, the child may be considered safe, the exceptions to this rule being very few. Miller * (Moscow) gives the following statistics of the time of beginning of symptoms in 1,000 cases:

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* Jahrbuch für Kinderheilkunde, Bd. xxvii, S. 359.

Symptoms appeared during the first week	85 cases.
“ “ “ “ second week	138 “
“ “ “ “ third week	240 “
“ “ “ “ fourth week	177 “
“ “ “ “ fifth week	86 “
“ “ “ “ sixth week	54 “
“ “ “ “ seventh week	50 “
“ “ “ “ eighth week	30 “
After the eighth week	140 “

Sometimes the constitutional symptoms—wasting, cachexia, etc.—are noticed before the local ones, but usually this is not the case. Generally the first symptom is the coryza or “snuffles,” which resembles an ordinary cold in the head, except that it persists. It is accompanied by a hoarse cry, indicating that the larynx participates in the catarrhal inflammation. Soon the eruption makes its appearance, being generally first seen upon the hands and face. Fissures and mucous patches may be seen upon the lips, about the anus, etc. With these symptoms there is often slight fever, the temperature usually ranging from 99° to 101° F. There may also be observed excessive tenderness about the shoulders, elbows, wrists, or ankles, due to acute epiphysitis, which may cause the child to cry from the slightest amount of handling, and the limbs may be moved so little that paralysis is suspected. There may be swelling near any of the joints mentioned.

In a severe case, as these local symptoms develop, the infant's general nutrition suffers in a very marked way. It loses steadily in weight; it becomes extremely anæmic; it whines and frets almost continually, but especially at night. The facies is so characteristic as to be almost diagnostic; the features have a pitiful, drawn expression; and the face is wrinkled, giving the infant the look of being very old. The skin has a peculiar sallow colour, which has been well described as *café au lait*. The symptoms may continue until a condition of extreme marasmus is reached, and death occurs from inanition, exhaustion, or from some intercurrent affection of the lungs or digestive organs.

In the milder forms of infection the severe constitutional symptoms described are not seen, although the local evidences of disease are almost as marked as in the cases just described. The severity of the symptoms is also much modified by treatment, especially when this is begun at an early period.

The most important local symptoms are the coryza, eruption, fissures about the mouth and anus, mucous patches, painful swellings at the extremities of the long bones, pseudo-paralysis, and onychia.

Coryza.—In most of the cases this is the first symptom. Beginning like an ordinary catarrh, it is distinguished by its severity and its persistence. There is a copious discharge of mucus and serum, sometimes of muco-pus, and often it is tinged with blood. Thick crusts form, which produce the usual symptoms of nasal obstruction; there is great difficulty in nursing; the infant breathes through the mouth, and the mucous membrane of the mouth is dry, causing great discomfort. If untreated, the process, which at first involves the mucous membrane only, may extend to the submucous tissue, causing ulceration; but the cartilages and the bones of the nasal fossæ are not involved till a later period in the disease.

The nasal catarrh is associated with more or less laryngitis. This causes hoarseness, which at times may amount almost to complete aphonia. There are very rarely symptoms of laryngeal stenosis. Dillon Brown has, however, reported one case in an infant six weeks old, which recovered after intubation.

Eruption.—This usually occurs after the coryza has lasted about a week; but the two may come at the same time; or the coryza may be absent or so slight that the rash appears to be the first symptom.

Occasionally there is seen a diffuse blush or roseola, but more frequently the eruption is macular, occurring in small, dark-red spots about the size of the infant's finger nails, usually circular and often slightly elevated; there is no surrounding inflammation, and rarely any itching. It is usually most abundant upon the face, the neck, and the anterior surface of the upper and lower extremities, especially the hands and feet, not infrequently extending over the entire body, although it is generally scanty over the shoulders and back. When it first appears the colour is bright, but gradually becomes of a dusky-red or coppery hue. After a little time very fine scales may be seen upon the surface of the red patches. The rash comes out slowly, usually requiring from one to three weeks for its full development. It fades gradually, leaving a coppery discoloration of the skin, which continues for a long time. The duration of the eruption is from three to eight weeks. It is shorter if active treatment is employed.

A papular eruption is rarely seen alone, but is usually associated with the macular variety. The papules are of a brownish colour and are hard. They are seen most frequently upon the palms and soles, and occurring alone they are not characteristic.

A squamous eruption is frequently seen upon the palms and soles, but very rarely elsewhere. In a few cases this scaliness forms the most distinctive feature of the cutaneous lesion.

Fissures and mucous patches.—These are among the most diagnostic features of early hereditary syphilis. Fissures are most frequently seen on the lips and about the anus, but they may occur about the nostrils and occasionally elsewhere. The fissures of the lips are really linear ulcers, and are distinguished by their persistence in spite of local treatment. They are multiple, deep, painful, and bleed easily. Those at the angle of the mouth are especially troublesome.

Mucous patches may develop from fissures, but more frequently from papules which are situated in regions where they are exposed to constant moisture and friction. They are very common upon the muco-cutaneous surfaces and wherever the skin is especially thin. The situations where they are most apt to be seen are about the lips, anus, scrotum, and vulva, but they may also be found behind the ears, between the toes, in the folds of the groin, axillæ, or buttocks. In size they vary from an eighth to half an inch in diameter; they are whitish in colour, have rounded borders, and are raised rather than excavated; they never extend deeply.

With these lesions there may be associated ulcers upon any of the mucous membranes, but they are most frequently seen in the mouth or on the genitals. The usual seat in the mouth is on the inner surface of the lips, the tongue, palate, or fauces; they are seldom symmetrical, and while they extend superficially they are never deep.

Hæmorrhages.—They are generally associated with the lesions of the mucous membranes, but sometimes occur without them. Slight bleeding from the nose and lips is not uncommon in ordinary cases of syphilis, and all hæmorrhages of the newly born are more frequent in syphilitic than in other children. Fischl has reported seven cases of multiple hæmorrhages in the newly born, associated with other symptoms of congenital syphilis. Mracek noted hæmorrhages in thirty-three per cent of 160 autopsies on syphilitic stillborn infants or those dying soon after birth. Examination of the blood-vessels in some of these cases showed infiltration of their walls and narrowing of their lumen. The vascular changes were thought to be the cause of the bleeding.

Nails.—The nails present several peculiarities in syphilitic infants. There may be a disease of the matrix resulting in suppuration and exfoliation of the nail—a true onychia. Sometimes the nails are repeatedly exfoliated; at other times they are deeply wrinkled or furrowed; or the dorsum is very much arched, and the nail appears as if it had been pinched near the matrix by a pair of forceps. Such nails are often expanded toward the extremity, and may be decidedly claw-shaped; they are frequently opaque, sometimes having a purplish discoloration; they may be short and split into layers. The most characteristic appearance is the narrow, pinched, claw-shaped nail; this is an early symptom of some diagnostic importance. The hair and eyebrows frequently fall out completely. This symptom is not usually present in very early infancy.

Pseudo-paralysis.—This is due to acute epiphysitis, and it may be the first symptom of hereditary syphilis to attract attention. It is usually noticed when the infant is a few weeks old that one or sometimes both arms are not moved, and that the parts are tender and painful when handled. The condition is easily confounded with peripheral birth palsies. The arm is very frequently held in marked inward rotation with the palm looking outward, resembling the position in Erb's palsy;

but careful examination makes it evident that the loss of power is only apparent, and that it is due either to the pain which motion produces or to epiphyseal separation. A history will usually be obtained that loss of power did not exist at birth, but developed subsequently. The electrical reactions in these cases are normal, and the rapid improvement under mercurial treatment is always diagnostic. The lesions of the viscera in early syphilis rarely give rise to any marked signs or symptoms, with the exception of the spleen, which is almost invariably found enlarged.

Late Hereditary Syphilis.—These symptoms may come on at any period during childhood or about the time of puberty, but very rarely at a later time than this. They are seen both in those who have had the usual symptoms of hereditary syphilis in early infancy, and in others where the most careful examination into the history fails to disclose any symptoms whatever of early syphilis. It is fair to assume in such cases either that early symptoms were absent or that they were of trivial importance. It is still a matter of dispute whether these late symptoms should be regarded as hereditary, tertiary syphilis, which has not previously given signs, or as the late stage of ordinary syphilis in which the early symptoms have been overlooked. It is certain that the symptoms are quite as apt to be severe when there is no history of early syphilis as when this has been typical. It is quite possible that some of these may be the late manifestations of the acquired syphilis not recognised in the early stage.

Late hereditary syphilis shows itself by symptoms which in acquired disease would be classed as tertiary. The most characteristic are the affections of the teeth, the bones, gummatous deposits in the solid viscera, the skin, or mucous membranes, the breaking down of which may lead to ulceration.

Teeth.—There are no peculiarities in the first teeth of syphilitic children except their proneness to early decay. They are rather more likely to appear early than late. Hutchinson states that there occasionally occur abscesses of the gum in young infants, on opening which the crown of the milk-tooth, usually an upper central incisor, may be removed.

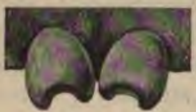
Fig. 180.—Typical "Hutchinson's teeth." (After Fournier.)

The characteristic teeth of syphilis are those of the second set. In estimating the diagnostic value of these changes, only the upper central incisors are to be relied upon; these are the test teeth. Although changes are frequently seen in other teeth, they are not always diagnostic. Typical syphilitic teeth, according to Hutchinson, have each a single notch in the centre of the edge (Fig. 180). The notch is usually shallow and more or less crescentic in shape. The enamel is generally deficient in the centre of the notch, and the tooth here is apt to be discoloured. The teeth are dwarfed, both as regards their length and width. They often taper regularly from the base to the edge, giving rise to the term "screw-driver teeth" (Fig. 181). The teeth are not so flat as the normal incisors, but somewhat rounded and peg-like. They are not properly placed, but incline either toward or away from each other. They are seldom large enough to touch the adjacent teeth on both sides.

Although Hutchinson's teeth may generally be taken as conclusive evidence of syphilis, they are not invariably so, as Keyes and others have shown. It is to be remembered in this connection that the absence of changes in the teeth is of no importance whatever as evidence that syphilis is not present. Hutchinson states that they are wanting in more than half the cases.

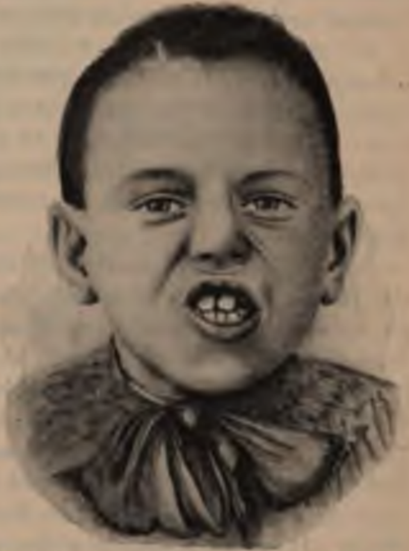

FIG. 181.—Syphilitic "screw-driver teeth." Boy nine years old. (Same patient as Fig. 148.)

Bones. — The form of disease which is usually seen at this period is an osteo-periostitis, affecting principally the shaft of the long bones and the cranium. It has already been described (page 853).

Lymph nodes.—They are much less frequently affected than in adults, and in early infancy they are seldom involved. In most cases after the first year there may be found a moderate degree of enlargement of the post-cervical and epitrochlear glands, swelling of the latter having considerable diagnostic value. They are situated just above the internal condyle of the humerus, and under normal conditions can scarcely be felt. In syphilitic children they may be as large as a pea or a small bean; sometimes two or three of them can be distinguished. They are so rarely enlarged from other constitutional conditions that, provided no local cause for the swelling exists, they should always create a suspicion of syphilis. The post-cervical glands are frequently affected, but are not so diagnostic. The degree of enlargement is rarely great. Occasionally there are seen in the neck large masses of swollen lymph glands which resemble tuberculous swellings. They are, however, very rare.

Special senses.—The most frequent affection of the eye in late syphilis is interstitial keratitis, the close connection of which with hereditary syphilis was first pointed out by Hutchinson. It is usually found associated with the typical notched teeth. The diagnostic value of keratitis in syphi-

lis is denied by Fournier, who states that, while
infrequently due simply to malnutrition. Both
and in all degrees of severity, from a slight hazin
plete opacity. However, with an early diagnosi
recovery may be expected in most cases.

Chronic otitis may be a result of the acu
infancy. There is nothing peculiar about the
cases. A form of deafness occurs in older chil
states is almost invariably due to syphilis. Its
without pain and frequently without discharge.
apt to be permanent, and if it occurs early in ch
deaf-mutism.

Skin.—The most important of the later manif
sist in the formation of subcutaneous gummata.
are indurated, elastic, of a grayish colour, with re
ment they disappear quite rapidly by absorption;
break down, leaving large deep ulcers. These
teristic in appearance, but may be confounded wi
losis. The syphilitic ulcer has rounded, thicke
and a base which is depressed and has the appe
out. It is sometimes covered by hard crusts and
areola. It leaves a smooth white scar. The mo
upon the face and upper part of the legs or thig
have usually soft, flat edges, and do not extend so
irregular in outline; the cicatrix left is of a pu
comes red and slowly fades. Tubercle bacilli ma
it is only by the effect of treatment that the dia
tween these two lesions.

Nose and palate.—Disease of these parts gener
ing down of gummatous deposits in the mucou
may in consequence be the seat of a protracted
The disease may take on a destructive form of ulce
phagedenic, and may cause rapid destruction of t
bones, perforation of the septum, and occasionally
fossæ. There may be necrosis of the turbinated
ethmoid. In the most severe forms the nose may
the course of a few weeks. There may be at the
tion of the soft palate, leading to perforation. In
almost invariably due to syphilis. In many parti
of the nose and palate resemble lupus; they ar
rapidity of their progress, syphilis often doing as
as is done by lupus in years (Hutchinson).

Other symptoms.—Syphilitic disease of the lar
in childhood. The former (page 457) may giv

aphonia and occasionally to stenosis; the latter* to a chronic cough and asthmatic attacks. There are no characteristic symptoms belonging to syphilis of the lungs. The different lesions of the central nervous system which may be due to syphilis are all quite rare. The forms have already been mentioned, and their symptomatology is discussed in Diseases of the Nervous System.

The only visceral changes which aid much in diagnosis are those of the liver and spleen. The liver is often enlarged, sometimes to a marked degree, and occasionally there is ascites, but very seldom jaundice.

Enlargement of the spleen is a very frequent symptom—in fact, it is almost constant during active syphilitic disease. I have several times seen it so swollen as to form an abdominal tumour of considerable size. In one case, in a boy three years old, the spleen extended five inches below the free border of the ribs, quite to the crest of the ileum. It was associated with moderate enlargement of the liver, as is usually the case.

In addition to the local symptoms of late hereditary syphilis enumerated, there are others of a general character which are quite as important. The body is usually undersized; the constitution is delicate, and shows but little resistance to all forms of disease; puberty is frequently delayed, and the development of the breasts and the genital organs often imperfect; anæmia is usually present, and the skin has a sallow appearance. Mentally, many of these children are somewhat deficient, and in a few instances they become idiotic, epileptic, or the subjects of dementia.

Diagnosis.—The diagnosis of early syphilis in most cases is not difficult. The coryza, eruption, labial fissures, mucous patches about the anus and genitals, and general cachexia,—all form a picture which it is difficult to mistake. In irregular cases the diagnosis is easy just in proportion to the number of the foregoing symptoms which are present. Special care should be taken not to confound the moist papules of simple intertrigo upon the buttocks or thighs with those of syphilis.

In late syphilis the following symptoms are the most reliable for diagnosis: notching of the teeth, falling in of the bridge of the nose, interstitial keratitis, deafness not traceable to ordinary otitis, enlargement of the spleen and epitrochlear glands, ulceration of the palate or nose, the sabre-like deformity of the tibia, and nodes upon the tibia or cranium.

Prognosis.—Generally speaking, the prognosis is much worse in infantile syphilis than in that of adults. In infancy it is much worse when hereditary than when acquired, for the reason that often the child who is the subject of hereditary syphilis has been affected by the poison from the very beginning of its existence, and this has modified its entire development.

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* See A. Seibert, M. D., in Archives of Pediatrics, vol. ix, for a report of four cases and others collected from literature.

in Moscow for ten years showed that of
tality was over 70 per cent.

Such a mortality as that indicated in the s
in institutions where little or no previous tre
In private practice certainly nothing approach

In addition to those who die early as the r
there must be added many whose constitutions
that they fall an easy prey in infancy to pne
forms of acute disease. The remote effects
hard to estimate; it exerts a modifying influen
childhood and even throughout the life of the

The prognosis in an individual case depe
the symptoms develop, the time when treatme
oughness, and upon the surroundings and m
child. The outlook is better the longer afte
appear; it is also better in infants who are
are artificially fed.

As compared with syphilis of the adult,
they occur early they are nearly always the resu
If proper early treatment is carried out, the se
patients are usually free from all symptoms un
until near the time of puberty—two periods wh

The prognosis is better in the later childre
in the earlier ones, provided infection has pr
children. This fact illustrates the general
poison to diminish in virulence as time pass
The following instance cited by Bertin well ill

In the first pregnancy, the child died at
second, at the seventh month; in the third, at
in the fourth the child was born at term, and
fifth it lived six weeks; in the sixth the child

The mother should be treated during her pregnancy: (1) if she is syphilitic, whether the disease was acquired at the time of conception or subsequently; (2) if the father is known to be suffering from syphilis, whether the mother has symptoms or not; (3) if the mother has previously shown signs of syphilis, but has had no active symptoms for a considerable period. In all these conditions if efficient treatment is carried on throughout pregnancy there is a strong probability, but in no case a certainty, that the child will escape. The third condition mentioned is the one in which treatment is most likely to be neglected, especially if the mother has previously borne a child who was not syphilitic. Syphilis, however, shows a strong tendency to reappear and become active during pregnancy, even though it has been long quiescent, as the following case cited by Diday shows:

A woman who had lost seven children from syphilis was put under treatment during the eighth pregnancy; result—child born healthy, and continued so. In the ninth pregnancy treatment was continued with a like result; in the tenth pregnancy, no treatment, child syphilitic, dying when six months old; in the eleventh pregnancy, treatment repeated, child healthy.

The danger of infection during labour is slight. If there are upon the genitals of the mother either a chancre or syphilitic ulcers, they should be thoroughly cauterized before labour.

As the greatest danger of infecting a child after birth is from its parents or a wet-nurse, syphilitic parents should be duly warned of the danger to their children, and especially should be cautioned against kissing them or sleeping in the same bed with them. The utmost care should be exercised to prevent a healthy child from being infected by a syphilitic nurse. A nurse should never be accepted without a thorough examination, no matter how clear a history may be given. As a syphilitic child in the household may be the means of infecting other children, the same precautions should be taken as in the case of other contagious diseases. The chief danger to other children comes from kissing or from using bottles, spoons, or cups which have been infected; as the syphilitic infant is chiefly dangerous on account of the lesions in the mouth. Trouble most frequently occurs because of ignorance regarding the nature of the disease. It is possible for a syphilitic child to nurse a healthy woman without communicating syphilis, if the child's mouth is treated and the nipple not allowed to become fissured; but it is an experiment which should never be tried.

Treatment.—This should always be begun as soon as the first positive symptoms of syphilis appear. Under certain circumstances it may be advisable not to wait for symptoms; as, for example, where both parents have recently suffered from active symptoms, where previous children have died soon after birth, or where, with marked symptoms in the parents, the child exhibits the cachexia of syphil symptoms. Such anticipatory treatment need than six weeks unless symptoms appear.

The indirect treatment, designed to reach mother's milk, has fallen into deserved disuse, as altogether unsatisfactory.

Mercury is as much a specific for hereditary There are many ways of introducing it into the by inunctions, by the mouth, by fumigations, by b In most cases inunction is the manner to be pre Gr.x of mercurial ointment, diluted with the same be rubbed daily into the palms, soles, axillæ, or t thighs. It is advisable to change the place of inu and if this is done, it is extremely rare that eryth any reason inunctions are objectionable, as they n are to be kept in ignorance of the treatment, eithe bichloride may be given by the mouth. The usual should be gr.j four times a day; that of the bichlo day, always well diluted. It is rare that larger dos the symptoms are urgent, it is often best to substi weeks, as the system can usually be brought more ence of mercury by this than by the other prepara four times a day is the usual dose required. Other tion and other preparations offer no advantages, vious disadvantages.

The iodide of potassium is to be used, either al with mercury, whenever such lesions exist as are tertiary. This includes all the late manifestatio whenever the bones or viscera are affected. The borne by children, and may be given in almost a infancy it is rare that more than twenty grains in older children the necessary amount may be fro daily. It should always be given largely diluted.

The duration of mercurial treatment should be doses during the last six months may be reduced t those employed while active symptoms are present. longer than a year if symptoms exist. It is often mercury continuously, but with short periods of int

The tonic treatment of syphilis is important an lected. After specific treatment has been carried larly if rapidly pushed, the child often becomes anæ from general malnutrition. Under such circumst wise to discontinue mercury altogether for a time, the dose very much, and administer cod-liver oil, tonics. Such a change is frequently found to act most beneficially, even when lesions are present, which perhaps have been very little or not at all affected by the specific remedies employed. A judicious combination of specific and tonic treatment is required in every case, whether the remedies are given simultaneously or alternately.

Local treatment.—Ulcerative lesions of the skin require cleanliness, dusting with calomel or iodoform, or bathing with the black wash. Mucous patches should be dusted with equal parts of calomel and bismuth. Fissures and ulcers of the mucous membranes should be treated by nitrate of silver. Phagedenic ulcers of the palate or nose should be cauterized with nitric acid or the acid nitrate of mercury. The late syphilitic ulcers of the skin, due to the breaking down of gummata, should be treated with iodoform.

CHAPTER XII.

INFLUENZA.

Synonym: La grippe.

INFLUENZA is an infectious, communicable disease, which is now generally admitted to be due to the bacillus described by Pfeiffer in 1892. It is a serious disease in children chiefly from its tendency to complications of the upper and lower respiratory tracts, in which respect it closely resembles measles.

Etiology.—Besides the bacillus of Pfeiffer, there are frequently found, either associated or separately, in the organs of patients dying from influenza, the streptococcus and the diplococcus pneumoniæ, for the development of which influenza creates conditions in the highest degree favourable.

Influenza prevails epidemically, and after epidemics it may be endemic for a number of years. In New York the disease has been present, according to Loomis, for at least twenty-five years, although it attracted little attention under the name of influenza until the great epidemic of 1891. Epidemics prevail chiefly in winter and spring. All ages are liable to the disease, infants under one year least so, and in some epidemics they may escape altogether. The disease has, however, been observed in infants only a few days old, where the mother was suffering from it at the time of delivery. The children most frequently affected are those from two to ten years of age.

The period of incubation is uncertain. It is usually short, being generally believed to be from one to seven days. No immunity is afforded by one attack; recurrences and second attacks are not uncommon in the same epidemic, and a patient who has once had influenza seems to be more susceptible to the disease in consequence.

Lesions.—There are no characteristic lesions of influenza; those which are most frequently found are due to catarrhal inflammation of the respiratory or the digestive tract. In some cases only the upper respiratory tract is involved, in which case the disease often spreads to the middle ear; in others, only the lower respiratory tract, this in infancy usually spreading rapidly to the lungs, and resulting in broncho-pneumonia. Inflammation of the stomach and intestines is much less frequent and, as a rule, less severe. This will be considered more fully under Complications.

Symptoms.—The symptoms of influenza are due to the systemic effects of a general poison, and to certain local congestions and inflammations which are regarded as complications. The two classes of symptoms—the general and the local ones—are found in all possible combinations.

1. *The mild, uncomplicated variety.*—This lasts from two to five days, occasionally a week. The onset is usually abrupt, with chilliness, muscular pains, and sometimes vomiting. The temperature ranges from 101° to 103° F. Even though the fever is not high, the prostration is considerable, and children are often ill enough to remain in bed for several days. The usual general symptoms which accompany fever are present. After the fever has subsided, the child is left weak and anæmic; convalescence is frequently protracted, and it may be three or four weeks before the general health is regained. This is the most common variety seen, the essential symptoms being fever and prostration without evidences of local inflammation. Often there is in addition a mild coryza at the outset and a slight but persistent cough.

2. *Uncomplicated cases of the severe type.*—These are not frequent in children. They are characterized by high temperature, severe toxic symptoms, and great prostration. They closely resemble cases of pneumonia, with the exception that the local symptoms and physical signs in the chest are wanting. The onset is usually abrupt with vomiting and headache, sometimes even with convulsions. The temperature ranges from 102° to 106·5° F. It more often remains steadily high than fluctuates widely. In three cases recently observed I have seen a temperature over 106° F. in uncomplicated influenza. Marked nervous symptoms are usually present; there may be headache, photophobia, delirium, stupor, opisthotonus, and convulsions,—strongly suggesting meningitis, but all usually lasting but a day or two. In other cases the tongue has a brown coating, the lips are dry and parched, the pulse is weak and rapid, and other symptoms of the typhoid condition are present. The duration of these severe attacks is from two to five days, where no complication develops; a slight fever may, however, continue for a week, or even two weeks, gradually subsiding until it reaches the normal. Although the

symptoms are very alarming, the attacks are seldom fatal unless pneumonia develops; but it is a long time before the full effects of such an illness have entirely disappeared.

3. *Cases complicated by catarrhal inflammation of the upper respiratory tract.*—In this group there are added to the general symptoms of the mild uncomplicated variety, a severe coryza, with pharyngitis and often stomatitis. The catarrhal symptoms differ from ordinary catarrh of these mucous membranes chiefly in severity. They are also likely to be more prolonged, and there is a greater tendency to involve the ears and the cervical lymph nodes. The usual symptoms of acute rhino-pharyngitis are present with its serous, sero-mucous, or muco-purulent discharge. The whole pharynx may be the seat of an acute, erythematous blush, or the mucous membrane may present a granular or spongy appearance. The tonsils are red; occasionally there is follicular tonsillitis; rarely membranous patches. The nostrils and upper lip are often excoriated from the nasal discharge. The mouth may be the seat of a simple or a herpetic stomatitis with superficial ulceration. These catarrhal symptoms are usually severe for three or four days, and gradually subside. In infants the temperature may be 104° or 105° F. at the outset, but continues high only for a day or two. In older children the temperature ranges from 100° to 102° F.

There are two complications which in infancy are very frequent,—otitis and cervical adenitis. Otitis may be either catarrhal or purulent. It runs the usual course of otitis following simple catarrhal processes of the pharynx, and usually terminates in complete recovery. Exceptionally these cases may go on to the development of chronic otitis, or the disease may extend to the mastoid cells. In addition to the severe cases, there are frequently seen attacks of catarrhal deafness from inflammation of the Eustachian tube. Pain in this form is less severe, and may be absent; there is no increased fever. Deafness is the chief symptom, and in most cases it disappears spontaneously.

The adenitis usually involves either the lymph nodes situated below the ear and behind the angle of the jaw, or those of the retro-pharyngeal region. The inflammation runs the usual course of such inflammations when associated with other diseases.

4. *Cases with broncho-pulmonary complications.*—A moderate amount of inflammation of the mucous membrane of the larynx, trachea, and large bronchi occurs in most of the cases of influenza. In the more severe forms, broncho-pneumonia or lobar pneumonia often develops. Sometimes the pulmonary symptoms do not appear for two or three days, or even a week; at other times they are coincident with the development of the fever and other constitutional symptoms, and, except for the prevalence of influenza, this would not be considered a factor in these cases. A striking feature in these attacks is that the temperature, prostration,

and cerebral symptoms are out of all proportion
and symptoms.

The broncho-pneumonia complicating influenz
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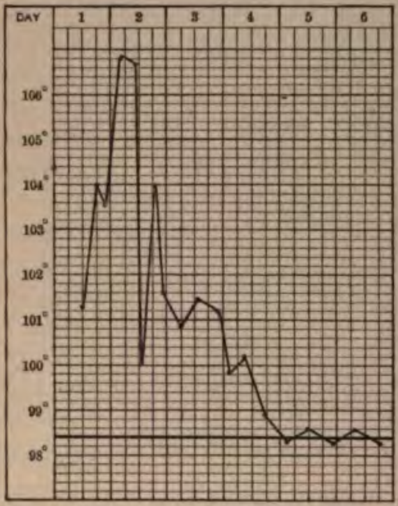

Fig. 182.—Acute broncho-pneumonia, abortive type, complicating influenza, in an infant six months old. The entire left lung posteriorly, was involved.

5. *Cases with gastro-enteric complications.*—V
are frequent at the beginning of influenza, and in s
infants, they may be the predominant symptoms of
may be large and fluid, or they may contain mucu
be passed with pain and tenesmus,—the sympto
acute gastritis or of ileo-colitis of moderate seve
these attacks is usually three or four days, and e
delicate children they are rarely fatal. In older
initial vomiting, abdominal pain, tympanites, pr
other symptoms strongly suggestive of typhoid feve

6. *Influenza in very young infants.*—The sever
der six months old often present peculiar features.
perature is frequently but little above the normal,
treme. The eyes are sunken, the face is pale, there
food is often refused altogether. In other cases ther
rapid respiration, indicating acute congestion of t
abnormal signs are present, except very feeble brea
always there is a disturbance of digestion, with vo
stools. Death may occur in two or three days; so

for a week, the chief symptoms being gradually increasing prostration, and finally collapse, without the development of any marked local evidences of disease. The system seems in these cases to be overpowered by the intensity of the poison. In other cases pneumonia develops, and from this death occurs.

Complications and Sequelæ.—The most frequent ones—pneumonia, otitis, acute adenitis, and gastro-enteritis—have already been considered. Cutaneous eruptions are not infrequent, and are often very puzzling. There may be a general eruption resembling urticaria, or an erythema which sometimes simulates measles, but more frequently scarlet fever. These eruptions are irregular in their course and often in their distribution, and are not followed by desquamation. In most of the cases with high temperature the urine contains albumin; although nephritis is rare, one should be on the watch for it even in young children. I have once seen acute pyelitis as a complication. The nervous sequelæ of adults—mental disturbances, multiple neuritis, etc.—are extremely rare in childhood, although they have been observed. One of the most frequent sequelæ is marked anæmia; this is well-nigh constant after a severe form of the disease. Following the disease of the mucous membranes, there may be enlarged tonsils, adenoid growths of the pharynx, or chronic enlargement of the cervical lymph glands. Attacks of influenza bear the same relation to the development of tuberculosis as do those of measles.

Convalescence after influenza is usually very slow, and it is often many months before the full effects of a severe attack have disappeared. A recurrence of the symptoms before complete recovery is not uncommon, and often second attacks during the same season are seen. For a long time the mucous membranes are in an extremely sensitive condition. Relapses are often brought about by slight exposure before the symptoms have quite disappeared, and I have often seen them occur simply from airing an infant in the room.

Diagnosis.—This is usually easy when the disease is epidemic. The sporadic cases often present great difficulties, particularly in the early part of the disease. It is often impossible to tell for two or three days whether the case is one of pneumonia, malaria, or influenza. In most of the severe cases I have seen, pneumonia has been the diagnosis first made; it is only by the course of the disease and the absence of any physical signs that influenza can be distinguished from pneumonia. From malaria, influenza is differentiated by the course of the temperature, the absence of enlargement of the spleen and of the plasmodium in the blood. The cerebral symptoms may lead to the diagnosis of meningitis; the catarrhal symptoms, to a suspicion of measles; and the vomiting, high temperature, and erythema to a diagnosis of scarlet fever. In all these cases it is only the course of the disease which clears up the diagnosis. Influenza is characterized most of all by severe constitutional

symptoms, without the development of any sig
it lacks the characteristic symptoms of the other

From ordinary catarrh, influenza differs only
bility, its severity, and the frequency with which
tis, adenitis, and pneumonia. Mild cases when
diagnosticated from simple catarrh of the respira

Prognosis.—As a rule, the type of influenza se
than that which occurs in adults. In the cas
healthy, few die except from pulmonary compl
majority of attacks are mild and recover promptl
ency to pulmonary complications is much greate
Uncomplicated cases are seldom fatal, except in i
old; and even though the temperature is very h
severe, recovery may usually be predicted so l
dence of serious complications. The prognosis o
fluenza is rather worse than that of simple bron
pends chiefly upon the age of the patients affecte
is particularly serious in the very young, or wh
complications, but rarely otherwise. In infants
pression which results may be the beginning of
trition which goes on to the development of ma
an easy victim to some other form of acute disea
of influenza may therefore be serious, even though
especially severe.

Treatment.—The communicability of the dis
that cases of influenza should be isolated whenever
particularly that delicate children, or those prone
should not be exposed to it.

The disease appears to be self-limited, runni
complicated, in from three to seven days. As the
the indications are to sustain the patient, to mak
ing the attack, and to prevent so far as possible th
cations. Every child with influenza should be put
so long as any elevation of the temperature contin
bowels should be opened by castor oil or calom
induce free perspiration, such as the use of hot d
small doses of Dover's powder in combination with
high temperature should be relieved by cold spon
precisely as in pneumonia, but large doses of anti
avoided. The nervous symptoms—restlessness, pa
disturbances—are best controlled by phenacetine i
deine—e. g., to a child of one year, phenacetine gr.
three or four hours. Double the dose may be gi
years. Alcoholic stimulants are required whenever

of weakness, as it does in most of the severe cases, and in most young infants. They should be given according to the same rules as in pneumonia. Next to alcohol, strychnine is the most valuable heart stimulant.

In older children there is a decided advantage in the use of moderately large doses of quinine—e. g., gr. ij, four or five times a day, to a child five years old; but in infants this had best be omitted, on account of its tendency to upset the stomach. The cough which so often persists after influenza is best controlled by cod-liver oil and creosote, used as after acute bronchitis. With persistent bronchitis which resists ordinary remedies, a patient should be sent to a warm, dry climate. The complications of influenza are to be treated as they arise, in the same manner as when they occur under other conditions. In all cases careful feeding in accordance with the general rules laid down for feeding in acute diseases, good nursing, and care to avoid exposure during convalescence, are essentials in treatment. One should be particularly anxious about patients who have a strong tendency to tuberculosis, and such cases should be watched with the greatest solicitude.

In prolonged or constantly recurring attacks nothing is of much avail except a change of air. If this is impossible, a child should be frequently removed from one apartment to another, as re-infection often appears to take place from the sick-room.

CHAPTER XIII.

MALARIA.

MALARIA is a general infectious disease due to the presence in the blood of a specific organism known as the *plasmodium*, or *hematozoön malariæ*. It manifests itself in children by the ordinary acute febrile attacks which are seen in adults and by chronic malarial poisoning. Both of these forms may present certain peculiar symptoms dependent upon the age of the patient.

Etiology.—The hematozoön malariæ was discovered by Lavaran in 1881. It is a parasite of the blood and belongs to the group of the protozoa.* The anæmia of malaria results from the extensive destruction of the red corpuscles caused by the growth of the parasite. How it enters the blood is as yet undetermined.

Malaria affects all ages, even the newly-born infant. We must accept

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* For a description of the plasmodium, methods of staining, etc., see James, New York Medical Record, 1888; Councilman, The Medical News, January 15, 1887; or Thayer and Hewetson, Johns Hopkins Hospital Reports, vol. v, 1895.

with some allowance the statements made by the
ject of intra-uterine infection, but in the follow
practice of my associate, Dr. Crandall, there se
disease was contracted *in utero*: For ten days b
had suffered from a tertian intermittent of mod
hours after birth the child was noticed to have
lips and nails, and a pinched face. These sympt
hour and were followed by a distinct fever. Up
paroxysm was repeated. Examination of the bl
child was made by Dr. Walter James, who foun
in both cases.

Malaria is more frequently overlooked in you
life, from the fact that its forms are more irreg
the belief that young children are less liable tha
believe, however, the opposite to be the case. I
stances where families have been exposed to m
noted that the young children were frequentl
symptoms of the disease.

Malaria is an endemic disease prevailing i
New York it rarely develops except in patients
fronts or in the districts contiguous to Central
suburbs malaria is exceedingly prevalent, and
of the cases coming under observation in New
may be seen at any season, but are more frequen
They are particularly liable to occur when the
patient is reduced by some other influence, espe
the digestive organs, and they often follow in the
fectious diseases. The poison of malaria may rem
for an indefinite time, producing symptoms when
able for its development are present.

Lesions.—Opportunities for a study of the pecu
malaria in children are infrequent, especially in
are extremely rare. I have myself seen but two. A
lesions do not differ in any marked way from the a
The most important changes are the destruction
the blood, enlargement, and in chronic cases hyp
tion of the spleen; less frequently pigmentation
and brain. Pneumonia and gastro-enteritis are o

Symptoms.—The clinical forms of malarial fe
to ten years old, do not differ essentially from the
Both intermittent and remittent forms occur, the
usually seen. Of the different varieties of intermitt
(Fig. 183) is the most common, although the ter
frequent, but the quartan is extremely rare. The

are generally well marked. The cold stage begins with a chill or vomiting, with headache, lassitude, and general pains. The hot stage is usually characterized by a higher temperature than in adults, and this is followed by the sweating stage, which is generally marked. The paroxysm may be repeated every day or every other day until controlled by quinine, or the stages may become less and less distinct as the disease progresses until a more or less remittent type of fever develops. Less frequently the fever is remittent from the beginning and the constitutional symptoms are of greater severity. In this form there is marked prostration, the tongue is thickly coated, there are often tenderness and pain in the region of the liver, and occasionally there is slight jaundice.

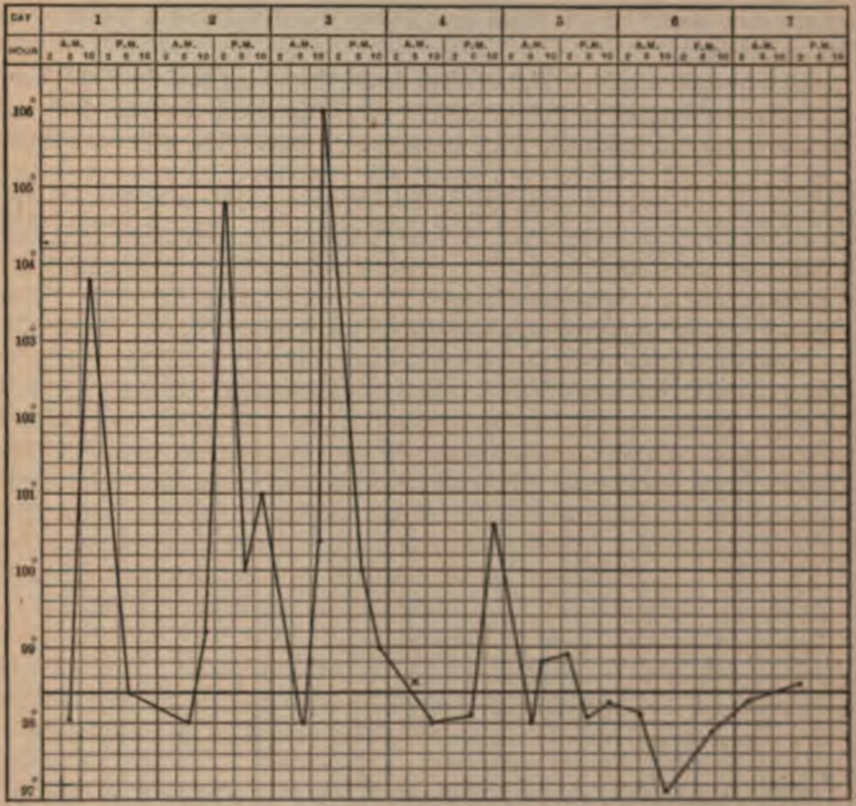

FIG. 183.—Typical malarial temperature, quotidian type, in a boy six years old. Each paroxysm preceded by a chill. It will be noticed that the temperature rose higher with each succeeding paroxysm; x marks the time when quinine was begun.

In infants and very young children the peculiar types of malaria are seen. A well-marked intermittent fever with distinct stages is quite exceptional, most of the cases assuming more of a remittent type or an irregular form of intermittent (Fig. 185). The onset is usually abrupt with vomiting, a well-marked chill being rare. I have seldom seen a malarial chill in a child under five years old. This is replaced in infants by cold hands and feet, blue lips and nails, sometimes slight general cyanosis, pallor, drowsiness, and prostration. Vomiting was present in two thirds of my own cases.* Four times have I seen a malarial attack ushered in by convulsions.

The fever is relatively higher than in adults, rising rapidly to 104° or 105° F., occasionally to 106° or 106·5° F. This continues from four to twelve hours and gradually falls, usually to normal. The other constitutional symptoms of the febrile stage are much less severe than in most diseases with the same elevation of temperature. The sweating stage is only

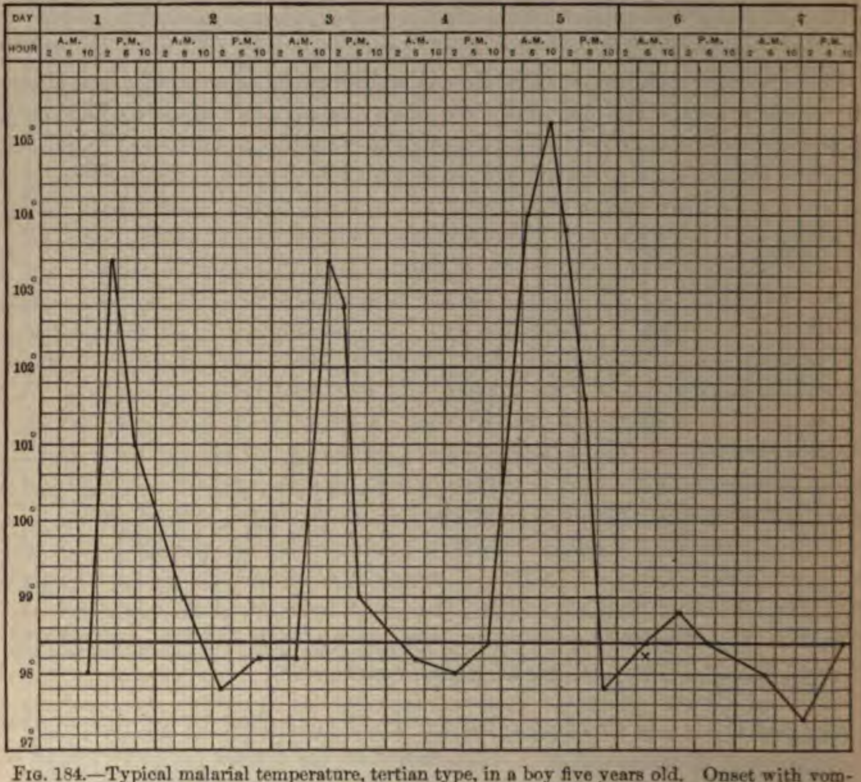

FIG. 184.—Typical malarial temperature, tertian type, in a boy five years old. Onset with vomiting and drowsiness, but no chill. This was an anticipating intermittent, the first paroxysm occurring at 3 P. M., the second at 12 M., the third at 10 A. M.; x marks the time when quinine was begun.

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* The Symptoms and Diagnosis of Malaria in Children. The American Journal of Obstetrics and Diseases of Women and Children, Nos. I to IV, 1883.

slightly marked and is often absent altogether. With the fall in the temperature there is a gradual subsidence of all the other symptoms of the febrile stage.

After the first paroxysm the patient may be quite well for several hours or even for a day, when the second paroxysm occurs. This is generally not so well marked as the first one, the third may be even less so, and the case may resemble more and more one of continuous fever with wide oscillations in the temperature. In some cases it is remittent at first and later becomes intermittent, but it is very rare under either circumstances that the temperature does not touch the normal point at some time in the twenty-four hours. In infants the quotidian has been in my experience very much more frequent than any other type, the tertian being rare and the quartan almost unknown.

Enlargement of the spleen is present in the great majority of cases, and usually to a sufficient degree to be readily appreciated by examination. The most satisfactory method of examination is by palpation (page 832). A spleen which can be easily felt below the ribs (except in the rare cases in which the organ is displaced downward by some condition in the thorax) is enlarged. When it is not sufficiently enlarged to be readily felt by a practised observer under favourable conditions for examination, it is not large enough to be of any diagnostic importance. None of the other symptoms occurring in malarial fever are characteristic; they are quite similar to those which are seen in almost all febrile attacks. There are anorexia, coated tongue, constipation, and restlessness.

Masked or Irregular Forms of Malaria.—These are quite frequent in young children, and are due to the presence of certain special or uncommon symptoms which may readily lead to a mistake in diagnosis. They are more often seen than cases of true malarial cachexia.

Among the most frequent of the irregular forms are those relating to the nervous system. Headache is exceedingly common and is usually frontal. When severe and associated with continuous drowsiness, vomiting, and constipation, it may lead to a strong suspicion of tuberculous meningitis. Vertigo is not a frequent symptom, but it is sometimes very prominent. Pains in various parts of the body are very common. A sharp severe pain at the epigastrium is frequent at the beginning of a paroxysm. It is often associated with tenderness, but has no relation to vomiting. Less frequently, pain is localized in the region of the spleen or liver. Trifacial neuralgia of malarial origin is rare in childhood. Aching or dragging pains in the muscles of the lower extremities are frequent symptoms during acute attacks, but they are of short duration, disappearing with the fever. They are to be distinguished from the acute lancinating pains of multiple neuritis, which is occasionally seen as a result of malarial poisoning. I have seen the latter in young children in three cases, and it has been observed by others. The pain is accompanied by tenderness of the muscles and nerve trunks, and by loss of power, which is usually partial.

Spasmodic torticollis (page 683) I have seen in eight cases, in which the condition seemed very clearly to depend upon malaria. This was shown by the fact that the spasm was intermittent, coming on every afternoon, but being absent in the morning; that it was accompanied by a slight rise in temperature, and usually by enlargement of the spleen; and that it was immediately controlled by quinine. This combination of symptoms seemed to be conclusive evidence of the malarial origin of the affection, although these cases were observed before the time when blood examinations were made.

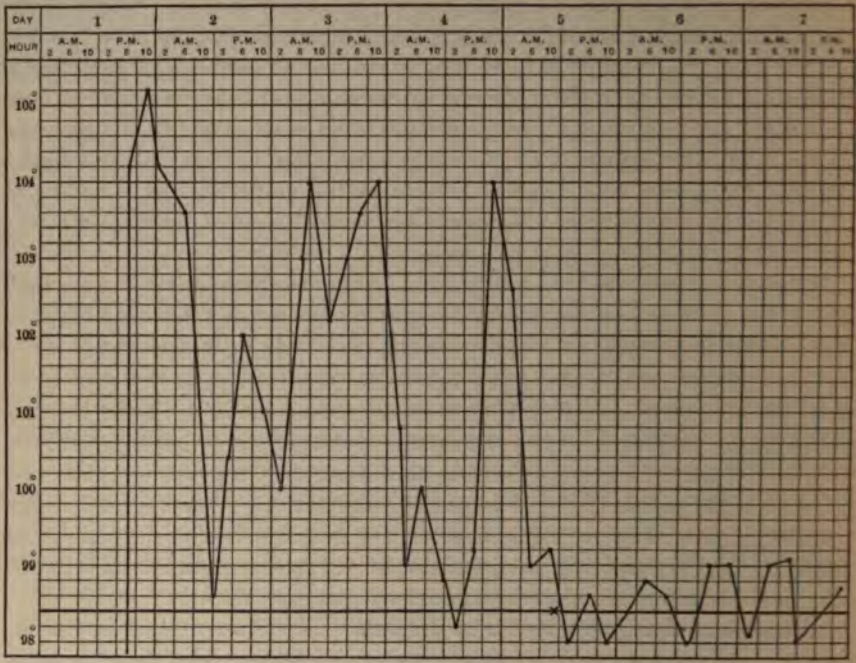

FIG. 185.—An irregular malarial temperature in a child nine months old. The paroxysm on the fourth day was accompanied by an attack of acute pulmonary congestion which came near being fatal; x marks the time when quinine was begun. Although the course of the temperature is irregular, it touched the normal line both on the second and fourth days.

Accompanying the paroxysm of malaria there is occasionally seen, more often in infants than in older children, acute pulmonary congestion (Fig. 185), which may give rise to obscure and often very alarming symptoms. There is an acute onset with vomiting and prostration, high temperature, cough, rapid respiration, and often slight cyanosis. On examination of the chest there is found feeble or rude respiration over one lung, or over both lungs behind, and sometimes coarse moist râles; these signs and symptoms may disappear in the course of a few hours with the fall in temperature, to return with the next paroxysm, or if quinine is given they may disappear entirely.* This group of symptoms has often led to the mistaken opinion that the disease was pneumonia, which had been aborted by the administration of quinine.

Subacute or Chronic Forms of Malaria.—The most constant symptoms are anæmia, enlargement of the spleen, and slight fever. The anæmia is usually marked, often being extreme. The enlargement of the spleen is distinct, and easily made out by palpation, and sometimes is very great. The fever is often so slight as to be discovered only when the temperature is taken five or six times in the twenty-four hours. The other symptoms are of a very indefinite character; there may be slight œdema of the lower extremities, general muscular weakness, so that the child is easily fatigued, loss of appetite, coated tongue, constipation, headache, muscular pains, and often cough from a slight bronchitis. These symptoms may depend upon many conditions other than malaria, even when they are seen in a malarial district. The only positive evidence of malaria in such cases is the presence of the malarial organisms in the blood. Even the swollen spleen, anæmia, and slight fever, which are often looked upon as diagnostic, may be present in cases of anæmia with which malaria has nothing whatever to do.

Diagnosis.—The positive diagnosis of malaria rests upon the demonstration of the malarial organisms in the blood. They will be found in nearly all the cases when examined under favourable conditions, which are: (1) that the examination be made by one with considerable experience in searching for malarial organisms; (2) that the examination be thorough;

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* The following case is a good example of this condition in its more severe form, and illustrates the difficulties in the diagnosis of malaria in infancy: A fairly nourished child, nine months old, who had been under observation in an institution for two weeks, was suddenly taken with vomiting and fever (Fig. 185). A cathartic was followed by a large undigested stool, and as the temperature then fell to normal, the attack was regarded as one of indigestion. On the third day the temperature was again high and accompanied by cough; coarse râles were found throughout the chest, and fine râles at the right base; it was then thought that pneumonia was developing. On the fourth day all the symptoms were so much improved that the infant was regarded as convalescent. At 6 P. M. the temperature was normal, and the infant went to sleep quietly. At 9.30 P. M. he awoke with a temperature of 104°, extreme restlessness, and marked dyspnœa. In half an hour his symptoms had increased to a point where he seemed likely to die. He became cyanotic, the respirations were of a panting character and rose nearly to 100 a minute, and he coughed with almost every breath; the pulse was scarcely perceptible. The severe symptoms continued for about an hour, then passed away gradually, and at the end of two and a half hours they had completely disappeared, and the child was in a quiet sleep which continued until morning. Malaria was now suspected, and the diagnosis established by the discovery of the plasmodium in the blood. The spleen was at this time much enlarged; the signs in the chest were those only of bronchitis of the large tubes. Quinine was now begun in full doses, and immediately controlled the temperature and the pulmonary symptoms.

(3) that it be made during the paroxysm; and (4)
have been previously given. Blood from the sple
show the organisms than that from the finger; and
nation should be of fresh blood as well as of dried
positive result is conclusive, a negative one is not al
impossibility of fulfilling all the above conditions.
examinations is somewhat difficult, and for the grea
fession a diagnosis must for the present rest upon
These, in order of their importance, I place as follov
spleen; prompt curability (especially in cases of fe
tinct periodicity in the symptoms; and a history of
trict known to be malarial. Particular importance i
therapeutic test. Recent experience emphasizes m
the fact that quinine has very little influence upon
malarial, and, conversely, that a fever immediately
trolled by quinine is pretty certain to be malarial.
all the above symptoms, even in the absence of a
blood, may be regarded as sufficient to establish the

The cachexia and course of the temperature in
broncho-pneumonia, tuberculosis, and empyema, ma
be mistaken for malaria. The fever and recurring
often attributed to malaria; as are also the heavines
coated tongue, and slight fever of chronic intestina
conditions accompanied by an enlarged spleen ma
malaria, especially simple anæmia, leucæmia, rickets,
malaria may be multiform in its manifestations, th
into no more serious error than to regard all ail
symptoms as malarial, neglecting careful physical ex
means alone accurate diagnosis is reached.

Prognosis.—Although it is seldom fatal in itself,
in an infant may so undermine the constitution tha
cumb to some other acute disease, usually of the lung
are often difficult to cure while the patient remains
tricts, and while a constant absorption of the poiso
other circumstances the prognosis of malaria is good.

Treatment.—The general treatment is sympto
conducted as in all acute febrile diseases. In the c
or a hot bath may be required; in the hot stage, ice
quent sponging. The bowels in all cases should be f
ably by calomel.

Methods of administration of quinine.—For inf
ence is to give the bisulphate in an aqueous soluti
teaspoonful, according to the age of the patient.
such a solution with less difficulty and vomit it less

combinations with the various vehicles supposed to cover its taste. In the event of failure by this method, the same solution may be given *per rectum* through a catheter. It should then be more largely diluted with some bland fluid such as gruel, and in double the dose. This is necessary, not only because absorption is less certain and complete, but also because a rectal dose can seldom be repeated oftener than every five or six hours. There is sometimes an advantage in giving part of the quinine by the mouth and part of it by the rectum; should both fail it should be given hypodermically. For this purpose the bimuriate of quinine and urea, the hydrobromate, or the bisulphate may be used. The salt first mentioned is to be preferred on account of its greater solubility. The bisulphate is the most irritating of these preparations and there usually follows some induration at the site of its injection, which may last a long time. This method of administration will not often be required, but in certain cases it is invaluable. Injections should be made deeply in the buttock or thigh; if the needle is clean no abscess will result.

For children from two to seven years old the taste of quinine must be concealed. An aqueous solution may be mixed with the syrup of sarsaparilla, orange, or yerba santa; or the powdered salt may be given in suspension in the same vehicle, the mixture being made in both instances just before the dose is taken; otherwise the partial solution of the drug will render the whole dose exceedingly bitter. When the dose required is not large, as in the milder cases, the lozenges of the tannate of quinine combined with chocolate answer the purpose admirably, for these are so nearly tasteless that children will take them without difficulty. Each lozenge usually contains one grain of the tannate, which is equivalent to about one third of a grain of the sulphate of quinine. A similar lozenge containing one grain of the sulphate may be made, which is often taken by children without the slightest objection. The bisulphate may be given in solution by the rectum, or, better, at this age, in the form of suppositories; but, as in infancy, with urgent symptoms, it is better to resort at once to the hypodermic method in case of failure by the stomach.

For children over seven years old, the same methods of administration may usually be employed as in adults. It is always preferable to give quinine in solution, or if not so, in capsule, but never in pill form.

In a case with well-marked paroxysms the quinine should be given in the interval, with the largest dose about four hours before the expected paroxysm. In infancy this plan is sometimes impracticable, as frequent small doses are usually better borne by the stomach than a few large ones. If other methods of administration are employed, however, this should always be done. I have never succeeded in getting the physiological effects of quinine by inunction, though there are good observers who claim this result. It is certainly a very uncertain way of introducing quinine into the system.

Dosage.—Relatively much larger doses of quinine are required for young children than for adults. Except for its tendency to disturb the stomach, quinine is borne remarkably well by little patients. Generally too small doses are given. An infant of a year with a sharp attack of malarial fever will usually require from eight to twelve grains of the sulphate (ten to fourteen grains of the bisulphate) daily. Occasionally I have found it necessary to give double the quantity referred to, and I have seen no unpleasant cerebral symptoms. It is useless to expect to control an acute attack of malaria by such doses as one grain three or four times a day. Children from five to ten years old require almost as large doses as do adults. None of the substitutes for quinine are to be relied upon in acute cases.

In chronic cases, arsenic and iron are usually required in combination with smaller doses of the quinine than those mentioned. For children over seven years old, Warburg's tincture may be employed. In most chronic cases a cure can be effected only by a change of climate.

The marked and irregular manifestations of malaria are to be treated in the same manner as cases of malarial fever.

SECTION X.

OTHER GENERAL DISEASES.

CHAPTER I.

RHEUMATISM.

THE rheumatic diathesis manifests itself in children by quite a different group of symptoms from those seen in adults; for this reason the disease was formerly supposed to be a rare one in early life. It is only within recent years that its frequency and its peculiarities have come to be appreciated. For our present understanding of the subject we are indebted largely to the work of English physicians, especially Cheadle,* who has brought out more fully than any one else the close connection existing between many conditions formerly not regarded as rheumatic. One who has in mind only the adult types of articular rheumatism, and regards arthritis as a necessary symptom for a diagnosis, will overlook in early life many manifestations which are clearly the result of the rheumatic poison. There is seen at this period a group of clinical phenomena, which often occur in combination or in succession, whose association was not understood until they were all discovered to be related to rheumatism. Sometimes one member of the group and sometimes another is first seen, but when one has appeared others are likely soon to follow.

Rheumatism in childhood, then, is manifested not alone by arthritis with acute or subacute symptoms, but by a large number of other conditions which are not to be regarded in the light of complications, but rather as forms of the disease.

Etiology.—It is not in the province of this work to discuss the various theories regarding the nature of rheumatism and its exciting cause. The drift of medical opinion to-day is strongly toward the view that acute rheumatism is an infectious disease, probably of microbic origin, although the character of the micro-organism is as yet unknown. The excessive formation of acids in the system may be regarded as a result of the infection, or possibly as a condition necessary for the activity of the specific poison. Under five years of age articular rheumatism is rare, and in infancy it is extremely rare. I have, however, once seen in a nursing infant, a little more than a year old, a typical attack of rheumatic fever with multiple joint lesions, and undoubted cases have been reported at as early an age as six months. Still, all these are very exceptional, and one should be wary of diagnosticating rheumatism during the first two years of life.

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* See the Harveian Lectures, 1889.

After the fifth year both the articular and the other manifestations of rheumatism become more common, and occur with increasing frequency up to the time of puberty.

Heredity is a very important etiological factor, and in fully two thirds of the cases that have come under my care, a rheumatic family history was obtained. Of the other important causes, the most frequent are living in damp dwellings, direct exposure to cold and wet, poor hygienic surroundings, and insufficient food. While seen among all classes, rheumatism is more common among those who are badly housed.

Attacks of rheumatism are seen at all seasons, but are much more frequent in the spring months. One attack strongly predisposes to a second, and in most cases there is a history of a large number of attacks of greater or less severity. Among my own patients, girls have been affected with greater frequency than boys.

Symptoms.—*The general and articular manifestations.*—The clinical types of rheumatism in children present very notable contrasts to those seen in adults. A typical attack of acute articular rheumatism such as is seen in adult life, with a sudden onset, high temperature, severe inflammation of several joints, profuse acid perspiration, and occasional delirium, is rarely seen in a child under eight or ten years old. In most of the attacks in childhood the onset is not very acute, the temperature is but slightly elevated—only 100° or 101·5° F.—the swelling and pain are moderate, and the redness is often absent. The number of joints involved is generally small, those most frequently affected being the ankles, the knees, the small joints of the foot, the wrists, or the elbows. These symptoms are often not severe enough to keep the patient in bed, and only the pain in the joints of the lower extremities prevents him from walking. The duration of these attacks is from one to three weeks, and in the course of a month most of them recover even without treatment.

Not infrequently the symptoms are limited to a single joint, usually the hip, knee, or ankle. Possibly the joints of the upper extremity are affected oftener than would appear, but disease here is much more likely to be overlooked than when lameness is present. The swelling is moderate and may not be evident except on a close examination; in some cases there is none. There is stiffness of the joint, as shown by lameness, and there may be so much pain and soreness that the child refuses to walk altogether. Muscular spasm about the affected joint is often marked, and may be the most striking objective symptom. The tenderness is sometimes localized, but it may affect the ligaments, tendons, and even the muscles. These symptoms may persist for two or three weeks and lead to the suspicion of incipient tuberculous disease of the joint. Rheumatism is distinguished by its more acute onset and usually by the presence of slight fever; some elevation of temperature being the rule, though it is not often much over 100° F. A family history of rheumatism, or a history of previous similar attacks in the patient affecting the same or other joints, or other manifestations of rheumatism, are also of assistance in the diagnosis. Occasionally all doubt is removed by the disease extending to other joints, or by the development of endocarditis. In some cases the symptoms are less in the articulation than in the muscles, and they are dismissed as simply "growing pains," having nothing characteristic about them except their occurrence in damp weather.

Cardiac manifestations.—These may occur where the articular symptoms are very mild, and in some cases where they are entirely absent. The most frequent is endocarditis. This is much more often seen in the acute rheumatism of children than of adults, and probably occurs in the majority of all severe cases; if it does not come in the first attack, it is likely to be seen in the later ones. It frequently occurs with a mild rheumatic arthritis, often being unnoticed until valvular disease of considerable severity has developed. Sometimes there is only high fever with severe constitutional symptoms of an indefinite character, but no arthritis, and no suspicion that the attack is rheumatic until endocarditis is discovered. Such cases are not infrequent. If the patients are kept under observation, articular symptoms are almost certain to develop later, and often there are other manifestations of rheumatism, especially chorea.

Pericarditis is less frequent than endocarditis, and usually occurs in children over seven years old. It is often associated with endocarditis. The most characteristic form of inflammation in early life is a subacute, dry, fibrous form, often resulting in great thickening with extensive adhesions, and frequently in obliteration of the pericardial sac. When once started it shows a strong tendency to recurrence and persistence.

The heart is so frequently affected in the rheumatism of childhood that it should be closely watched whenever articular symptoms are present, no matter how mild they may be; and not only in these cases, but in all the conditions hereafter enumerated with which rheumatism is likely to be associated.

Inflammations of other serous membranes—the pleura, peritonæum, and pia mater—were much more frequently ascribed to rheumatism in the past than now. There is little doubt that on rare occasions any one of these may be due to rheumatism. The pleura is most often involved, but even this is rare in young children.

Torticollis when it occurs acutely is frequently rheumatic. This form is characterized by its sudden development, continuous spasm, the great amount of muscular soreness, the moderate pain, and the fact that it usually disappears spontaneously after a few days. It is often seen in con-

nection with a rheumatic sore throat. Other ma
rheumatism are less characteristic and usually
extremities.

Anæmia is almost invariably seen in rheuma
and between the attacks. The effect of the rh
blood resembles that of malaria. The presence
and its degree often so marked, that one may ha
tinguishing cardiac murmurs which are hæmic
carditis.

Chorea.—In the article upon Chorea (page
cussed the association of that disease with rheum
own belief in a very close relationship existing b
infrequently chorea is the first manifestation of
to be followed soon by articular symptoms or by e
symptoms. In other cases chorea and acute enc
without articular symptoms, or all three may be a
the three conditions is first seen, the physician s
lookout for the others. The frequency of rheum
has been variously estimated by different observer
fifty-six per cent gave unmistakable evidences of

Tonsillitis.—Children who are the subjects
acute tonsillitis and pharyngitis should be regarde
and should be closely watched for other signs of
examination of the family history usually reveals
matism. Acute tonsillitis often ushers in an at
carditis or arthritis, and in one of my own cases
discovered after an ordinary attack of tonsillitis i
previously was normal and who had exhibited no
the different forms of tonsillitis, quinsy is most
rheumatism.

Subcutaneous tendinous nodules.—General at
to these as a manifestation of rheumatism by Barl
who described them as "oval, semi-transparent, f
sago grains." They are most frequently found at
over the malleoli, at the margin of the patella; oc
sor tendons of the hands, fingers, or toes, or over
the vertebræ or the scapulæ. They are compose
vary in size from a large pin's head to a small b
large as an almond. The nodules may come in
weeks and then disappearing, or they may last
tion of nodules is usually coincident with other rh
These nodules are better felt than seen, althoug
they are visible if the skin is tightly drawn. The
mon in this country; notwithstanding that I have

ine rheumatic patients for them, I have seen them but seldom, and they have been marked in only two or three cases. This, I think, has also been the experience of most observers in New York. From published reports, however, they appear to be much more frequent in England. There can be no doubt regarding the connection of these nodules with rheumatism.

Erythema.—The connection between rheumatism and the various forms of erythema—marginatum, papulatum, and nodosum—has been very clearly shown by Cheadle. None of these are frequent conditions in childhood, but when seen they should always suggest rheumatism.

Purpura.—The association of purpura with rheumatism is so often seen that there can be little doubt of the close connection between the two conditions. Rheumatic purpura, however, is quite distinct from the other forms of purpura, and is a much less frequent disease.

Diagnosis.—In order to recognise rheumatism in a child, one must free his mind from preconceived notions of the disease drawn from its manifestations in adults, as very few cases correspond to the adult type of acute rheumatism. In early life the disease is recognised not by any one or two special symptoms, but by the association or combination of a number of conditions which may appear unrelated. In determining whether or not any given set of symptoms is due to rheumatism, one should consider: (1) The family history, since in early life heredity is so important an etiological factor; (2) the previous history of the patient, not only as regards articular pains and swelling, the slight joint-stiffness without swelling, the indefinite wandering pains of damp weather, and the so-called growing pains, but also the previous existence of chorea, frequent attacks of tonsillitis, torticollis, or erythema; (3) the examination of the patient, which should include a careful search for tendinous nodules, as well as a thorough examination of the heart for signs of endocarditis or pericarditis, and, in cases which are at all acute, the temperature. In doubtful cases with mon-articular symptoms much importance is to be attached to the presence of slight fever, the abrupt onset, and tenderness of the neighbouring muscles and tendons,—all occurring without a history of traumatism. Rheumatism is more often overlooked than confounded with other diseases; although in childhood multiple neuritis and tuberculous and syphilitic bone disease are often mistaken for it, and in infancy the same is true of scurvy. The extreme infrequency of rheumatism during the first two years of life should always make one skeptical regarding it. In an infant, when the symptoms are confined to the legs and are not accompanied by fever, they are almost certain to be due to scurvy even though the gums are normal and ecchymoses have not yet appeared (page 213).

Prognosis.—Rheumatism in a child is in itself seldom if ever dangerous to life. In the great majority of cases the articular symptoms soon

disappear, even without special treatment. The d
consists in its cardiac complications. One attack o
certain to be followed by others, and when once
fected its lesions are likely to increase with each re

Treatment.—Rheumatism in children derives it
its relation to cardiac disease. Cardiac complicati
so serious that everything possible should be don
from those who by inheritance are especially predi
its recurrence in a child who has once had the disea
to prevent the heart from being involved. The rela
tism is very imperfectly understood; but it is cer
matic children do much better upon a diet comp
nous food, where starches are restricted in amount,
should be freely given in all cases. The underclo
nel during the entire year, in summer the light
The feet should be carefully protected, and expo
avoided. In-door occupations should be chosen fo

The tendency to recurrence is so strong in this
rheumatic antecedents, who has shown in the va
marked predisposition to rheumatism, and who
though a mild one, should, if possible, spend th
some warm, dry climate, or even remain there perm
most such children, it is only a question of time w
attacks, the heart will become involved.

To avert the danger of cardiac complications du
matism, or to limit their extent, there are two thin
ably be insisted on: first, to confine to the house an
child with rheumatic pains, no matter how mild; s
present, to keep the child in bed while it continu
never be above 100° F. Absolute rest and the eq
secured are unquestionably of more importance tha
tecting the heart during a rheumatic attack. With
be combined an early diagnosis. In very many, per
harm is done before the true nature of the disease
toms being dismissed as of slight importance beca
festations are not very severe. Children who have
should be closely watched during chorea and ot
rheumatism, the heart should be frequently exami
should be on the alert for the first articular sympto

Aside from the measures just mentioned, the tr
in childhood is to be conducted very much like tha
most acute attacks either salicylate of soda, oil of
should be given; as the majority of cases are not
provement is by no means always obtained by

should be given in all cases, but particularly in those in which there is hyperacidity of the urine. Either the acetate or citrate of potassium or the bicarbonate of sodium may be used, a sufficient quantity being administered to render the urine alkaline.

Quite as important as these drugs is the use of general tonics, particularly iron and cod-liver oil. These should be given not only between attacks to fortify patients against their recurrence, but also in subacute cases which are sometimes influenced very little or not at all either by salicylates or alkalies.

CHAPTER II.

DIABETES MELLITUS.

In this chapter will be attempted only a description of the peculiar features which diabetes presents when affecting young patients. It is a very infrequent disease in children. Of 1,360 cases of diabetes collected by Pavy, only eight were under ten years of age. In a series of 700 cases collected by Prout, only one case was under ten years. In a series of 380 cases collected by Meyer, only one case was under ten years of age.

Etiology.—Stern, in a series of 117 collected cases of diabetes in children, states that 47 were females and 31 males, the sex in the other cases not being given. Although extremely rare, cases have been observed during the first two years, and even during the first year of life. Statistics on this point are not altogether trustworthy, since some cases of temporary glycosuria have certainly been included.

Among the etiological factors, heredity is one of the most important. Pavy reports the case of a child dying of diabetes at two years in whose family the disease had existed for three generations. Inherited gout, insanity, and nervous diseases generally, may be looked upon as factors in the production of diabetes. Several of the cases reported in children have been preceded by injuries received upon the head. In a few cases the disease has followed the consumption of large quantities of sugar for a long time. In very many cases no adequate cause can be found.

Symptoms.—The most important early symptoms are thirst, polyuria, and wasting; their development is often quite rapid. The thirst is intense, often leading children to drink four or five pints of fluid a day. The amount of urine passed varies from one to eight quarts daily. The specific gravity is from 1,026 to 1,040, and the amount of sugar is from five to ten per cent, rarely more. Albumin is not infrequently present. Incontinence of urine is an important symptom, and often one of the earliest to be noticed. The wasting is usually quite rapid, so that a child may lose as much as six or eight pounds in a month. It is generally accompanied by anæmia. The appetite may be poor; at times, however, it is voracious. Other symptoms of less importance are a dry mouth, scanty perspiration, irregular sleep, occasional epistaxis, furuncles and abscesses, decayed teeth, and genital irritation.

The course of the disease is much more rapid in children than in adults, and, as a rule, the younger the child the more rapid its progress. The majority of cases prove fatal in from two to four months from the time the symptoms are sufficiently marked to make the diagnosis possible. Very few last more than six months; occasionally, however, one of the milder type may be prolonged from one to two years.

The progress of the disease is marked by continuous wasting, which may result in a marked degree of marasmus, and prove fatal. Some are carried off by intercurrent pneumonia or tuberculosis, but the majority die comatose. When coma develops, the case may be considered hopeless, and death is likely to be postponed but a few days. The cause of diabetic coma has not yet been satisfactorily explained, but it is usually believed to be due to acetonæmia.

Diagnosis.—Diabetes is apt to be overlooked, because of the common neglect of urinary examinations in children. The prominent symptoms—thirst, polyuria, and wasting—when associated, should always attract attention. Incontinence of urine, accompanied by marked wasting, is always suspicious. In some cases genital irritation may be the most prominent early symptom. A positive diagnosis is made only by an examination of the urine.

Prognosis.—In few diseases is the prognosis so bad as in diabetes in children. So high an authority as Senator declares that diabetes in children is hopeless and all treatment is useless. From a study of seventy-seven cases, Stern reaches the same conclusion. There are, however, cases on record in which recovery is believed to have taken place, even when the amount of sugar passed was large.

Treatment.—The indications for treatment are the same in children as in adults: first, diet; secondly, stimulants; thirdly, general hygienic measures; and, finally, the use of drugs, of which at the present time the favourites are codeine, salicylate of soda, and the bromide of arsenic.

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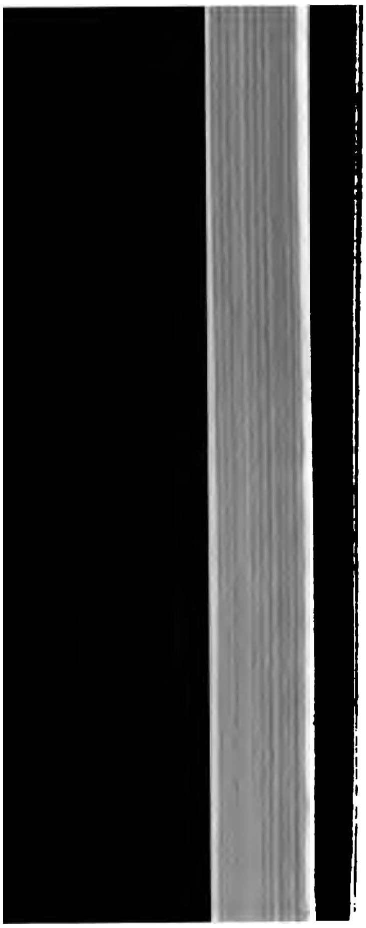

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